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12 May 1982

USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

(FOUO 8/82)

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USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

(FOUO 8/82)

CONTENTS

HARDWARE

UDC 681.581.5:681.3

SYSTEMS FOR INPUTTING INFORMATION FROM PNEUMATIC TRANSMITTERS INTO CONTROL COMPUTER SYSTEMS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 pp 16-18

[Article by engineers V. A. Yashin, Yu. M. Grenaderov, V. I. Durayev and V. P. Gumenchuk]

[Text] Inputting information from transducers of process parameters with a pneumatic unified output signal (called pneumatic transmitters from here on) into control computer systems is a problem in engineering implementation of automated process control systems in the chemical, petrochemical and related industries. As the practice of development of such automated process control systems indicates, signals from pneumatic transmitters, as a rule, account for 50 percent of the overall amount of information input automatically.

The most widespread method of inputting information from pneumatic transmitters into control computer systems uses individual analog pneumoelectric converters that convert a unified pneumatic signal of 20 to 100 kPa (0.2 to 1 kgf/cm^2) into a unified electrical signal of 0 to 5 mA that then goes to the load units (BN) in the USO UVK [devices for object communication with a control computer].

The widespread application of this information input method has caused a severe shortage of pneumoelectric converters, which is increasing continuously because of the increase in the number of automated process control systems that are being developed. Information systems built on the principle of individual conversion of signals turn out to be very bulky and inconvenient in operation, and monitoring the working order of the information channels in them is difficult. Existing engineering solutions for group checking of the converters by using pneumatic swicthing devices and reference elements for standard pressures are also not noted for compactness [1]. More promising is the input of information from pneumatic transmitters that have group switching and converting devices within them.

Information from transmitters is usually input now by using PK-3 type pneumatic switches, controlled by control computer systems, that switch pneumatic signals in advance [2]. In doing so, there is one PK-3 switch and PE-55M converter for every seven pollable pneumatic transmitters (one switch input is usually taken up by a source of standard pressure and is used to check the working order of the converter). Using this information input method permits a substantial reduction in the number of pneumoelectric converters and a solution to the problem of checking them in each polling cycle. However, this method has a number of substantial shortcomings.

As industrial tests of these systems have shown, polling the pneumatic transmitters takes no less than 16 seconds of machine time in each cycle. During this time, the control computer cannot perform other tasks. The PE-55M pneumoelectric converters often fail (adjustment is knocked off) because of the constant sudden changes of pneumatic signals at the inputs. The information systems continue to remain rather cumbersome.

The most promising method of inputting information into control computer systems from pneumatic transmitters at the current level of development of technology is the speeded-up balancing method based on simultaneous comparison of the transmitter signals with a developed balancing signal by using null-balance devices placed in the individual transmitter circuits. There are a number of ways to implement this method [3, 4]. However, at present there are only two systems in which these methods have been implemented for inputting information into control computer systems from pneumatic transmitters.

One such system is called the ASTRA-01 [5]. It is used for multichannel input of information from pneumatic transmitters into a control computer system. The system can be used with the 1010V, M-6000, SM-1 and SM-2 control computer systems with the availability of the appropriate software developed in setting up the automated process control system. The system output signal is an electrical 16-bit binary code. A control computer system controls the system by an electrical 10-bit binary code. The principle of system operation is based on the method of scanning the channels in the space of the parameter. The input channels are permanently connected to the individual comparison circuits. In one conversion cycle, the input signals of all channels are compared to a common saw-toothed balancing signal. The output signals of the comparison circuits are converted into time intervals proportional to them that are converted into codes by using the control computer.

The system has a modular structure and fits in a standard cabinet.

ASTRA-01 System Specifications

Basic error in measuring pneumatic signals as a percentage of the range of variation of input signals, no more than	±1.5
Maximum number of pneumatic inputs	120
Time for polling 120 pneumatic channels, in seconds	15-40

Prototype ASTRA-01 systems are in operation in the nitron and monomer shops of a chemical plant.

The shortcoming in the system is the long transmitter polling time, just as in the information input systems using the PK-3 pneumatic switches. In this system, it is difficult to implement metrological monitoring of the information channels since here only the control computer system itself can be the metering device.

The Dzerzhinskiy branch of the OKBA [Experimental Design Office for Automation] has developed and manufactured a prototype system for inputting information from pneumatic transmitters in which the saw-toothed pneumatic output signal of the scan generator is fed simultaneously to the inputs of the null-balance devices and to an analog pneumoelectric converter (APEP) [6]. An electric signal of 0 to 5 mA goes from the APEP converter to the analog input (load unit) of the USO UVK [devices for object communication with the control computer system]. The signals output from the null-balance devices (closing or breaking of the electrical contacts) are fed to the inputs for the system for inputting the iniative signals of the control computer system.

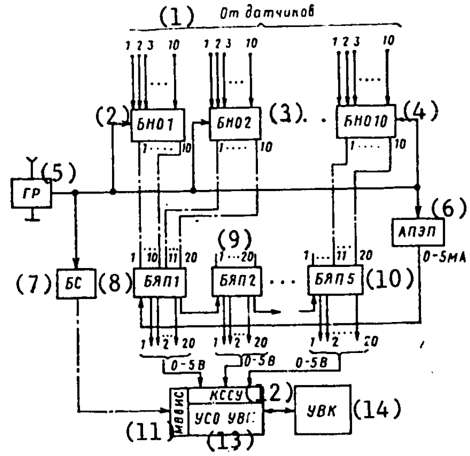
The system principle of operation is based on the fact that during operation of the next null-balance device, the control computer system receives an interrupt signal and executes polling of the analog input with subsequent transfer of the information to the appropriate storage cell. In the process, no special time is required for polling of the pneumatic transmitters. There are no severe pressure surges at the APEP converter input. Metrological checking of the information channels is not complicated. Automatic checking of the working order of the APEP converter is easily accomplished in each control computer cycle of operation (by connecting one or more sources of standard pressure to the device input channels instead of transmitters). The system has a simple design. Experimental industrial trials of this system have shown its serviceability during operation under the conditions of the process shops within the hardware for an automated process control system.

The shortcoming in this system is the presence of a large number of interruptions in each operating cycle of the control computer system (corresponding to the number of polled transmitters), which leads to considerable complication of the software for the automated process control system and reduces its operating reliability.

An effort is now underway at the Dzerzhinskiy branch of the OKBA to further improve the system for inputting information from pneumatic transmitters that implements the speeded-up balancing method. In the process, the following goals have been set: the system must basically consist of series produced automation hardware; automatic monitoring of the working order, the capability of repair at the place of operation and monitoring of the metrological characteristics of the information channels have to be provided for; and use of the system must not complicate the automated process control system software.

All the units of a system, preliminarily called the OKA-01, that meets these requirements have now been developed and tested under industrial conditions. A diagram of the system is shown in fig. 1.

The system operates the following way. The scan generator (GR) continuously puts out a pneumatic signal varying according to the saw-toothed law. The signal varies within the standard range of 20 to 100 kPa. The generator operating cycle is set equal to the control computer system operating cycle. The signal output from the scan generator goes to the inputs of the null-balance devices (BNO), the APEP converter and the signalling units (BS). The null-balance devices are acrylic plastic boards with comparison elements (P2ES1) and discrete pneumoelectric converters (PIPR.4) installed on them. Each unit is designed for 10 input channels from the pneumatic transmitters. Signals from the latter are fed to the anechoic chambers of the comparison elements, and the signal output from the scan generator (GR) goes into their other anechoic chambers. At the moment of equalization of these signals, the comparison elements operate and the normally closed contacts of the corresponding discrete pneumoelectric converters are broken. The breakings of these contacts are the output signals of the null-balance units.



Key:
1. from transmitters
2. BNO1 [null-balance unit 1]
3. BNO2 [null-balance unit 2]
4. BNO10 [null-balance unit 10]
5. GR [scan generator]
6. APEP [analog pneumoelectric converter]
7. BS [signalling units]
8. BYaP1 [storage cell unit 1]
9. BYaP2 [storage cell unit 2]
10. BYaP5 [storage cell unit 5]
11. MVvIS [module for input of initiative signals]
12. KSSU [switch for signals of mean level]
13. USO UVK [device for object communication with control computer system]
14. UVK [control computer system]

Fig. 1. Diagram of OKA-01 system for information input (modification for 100 pollable transmitters)

The APEP converter is used to convert the pneumatic signal output from the scan generator (GR) into a current signal of 0 to 5 mA, which goes to the analog input of the storage cell unit (BYaP1). The storage cell units convert the current signal into a proportional potential signal of 0 to 5 V, store in the storage cells the values of the potential signal that correspond to the transmitter output signal at the time of operation of the null-balance device and hold in storage the stored values of the potential signals for the generator (GR) operating cycle time.

A storage cell unit schematic is shown in fig. 2. Each unit includes 20 storage cells made of an inetgrator built with an operational amplifier (microcircuit K284UD1A) and a KP305 field transistor [7]. The circuit features inclusion in the feedback circuit of a source follower stage made with the KP305 field transistor. This enables high ohm input of the integrator, which permits with relatively low values of capacitance of C1 storing the input potential signal with the necessary degree of precision for a long time interval and including in parallel a large number of cells. Fig. 2 shows a developed view of one of the 20 cells of the BYaP [storage cell unit] (cell 1 of the BYaP1 unit).

The circuit operates the following way. A current signal of 0 to 5 mA goes to the input resistance R_{in}, entering into the BYaP1 unit. Removed from this resistance are the potential signals from 0 to +5 V which are then fed in parallel to all the analog inputs of the storage cells of both the BYaP1 unit and the other units.

When switch B1 closes, the input voltage goes to transistor gate T, is followed in it and fed to the inverse input (13) of differential amplifier D. The voltage at the output of the latter in magnitude is close to the input and is opposite to it in sign. The output voltage is applied to the second plate of the capacitor C1 and

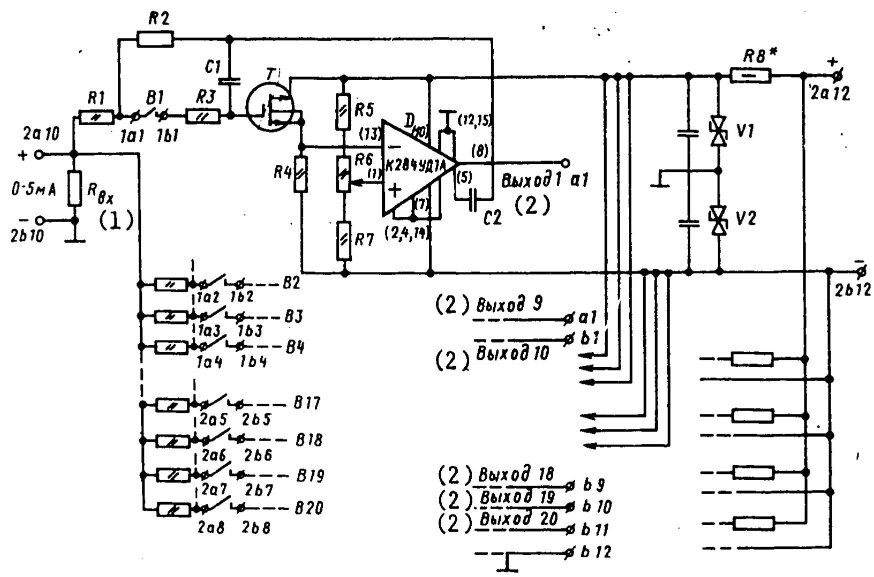


Fig. 2. Storage cell unit schematic: R1 - R7 are resistors (R1 = R2 = 20 kilohms; R3 = R4 = R7 = 100 kilohms; R5 = 91 kilohms and R6 = 10 kilohms);
T is a KP305 type transistor;
V1 and V2 are KS162 diodes; and
R_{in} = 1 kilohm $\pm 0.2\%$

Key:
1. R_{in}
2. output

charges it to the level equal to the input. When switch B1 opens, the voltage at output (8) of the integrator will be determined by the stored value of the voltage in the capacitor C1. A voltage divider, made with transistors R5-R7, is used to set the initial zero voltage at the output of the integrator with zero input (zero adjustment). Capacitor C2 is correcting and is designed to eliminate excitation of the D microcircuit at high frequency.

Used as switches $B1-B_n$ (n is the total number of storage cells) are the normally closed contacts of the corresponding null-balance devices. During operation of the null-balance device in turn, the circuit of the input analog signal of the corresponding storage cell is broken and stored at its output is the value of the potential signal corresponding to the value of the transmitter output signal.

In level, the BYaP cell output signals correspond to the mean level of the UVK [control computer system] and go directly to the switches for signals of mean level in the USO UVK [device for object communication with control computer system].

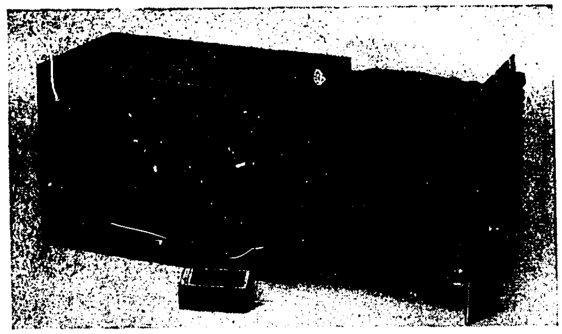


Fig. 3. External view of unit of storage cells for 20 channels (modification for installation in distribution rack of an M-6000 UVK [control computer system])

When the scan generator (GR) output signal reaches maximum (100 kPa), the signalling unit (BS) operates (see fig. 1) and emits a discrete electric signal (closing of contacts) to the input of the module for the input of initiative signals (MVvIS) in the USO UVK [device for object communication with the control computer system]. At this signal, the control computer interrupts operation on the main programs and polls the inputs of the switch for signals of mean level (KSSU), where the signals go from the storage unit cells. In the process, practically no machine time is taken up for polling of the pneumatic transmitters and the automated process control system software is not complicated.

Two system hardware versions have been developed: a separate unit and a distributed. In the first version, all system units are placed in a separate standard cabinet, in the lower part of which are installed the terminals for the leads of the pneumatic cables. The cabinet is placed next to the distribution racks of the USO UVK [device for object communication with control computer system]. In the second version, the BNO [null-balance unit] of the scan generator (GR) and the signalling unit (BS) are installed in a separate cabinet in the space for the converters. The storage cell units (BYaP) are made in the form of separate units (fig. 3) and placed in the distribution racks of the USO UVK. Shielded cables connect the BYaP cells and the null-balance unit. A specific version is chosen in developing the automated process control system hardware structure. Also solved simply in this system are the problems of monitoring the working order of the APEP converter and metrological monitoring of the information channels.

OKA-01 System Specifications

Number of pollable transmitters	20 or more (added in groups of 20 each)

Basic error of measurement of pneumatic signals (from range of variation of input signals) as a percentage, no more than	1.5 in the range of signals of 20-100 kPa; 1 in the range of signals of 52-100 kPa
Polling time (for 100 transmitters)	no more than 0.1 second
Level of output signals	0-5 V
Time of retention in storage of output signals	no less than 10 minutes
Distance between null-balance devices and storage cells	up to 50 m

Tests of the OKA-01 system units within automated process control system hardware have shown that this system may find extensive application in developing automated process control systems for the chemical and related industries, the information systems of which contain a large number of pneumatic transmitters.

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8545
CSO: 1863/32

UDC 531.787.611.91:531.781.2

USE OF SILICON-ON-SAPPHIRE STRUCTURES IN LOW TEMPERATURE PRESSURE TRANSDUCERS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 pp 20-21

[Article by G. I. Lur'ye, engineer, V. M. Stuchebnikov, candidate of physical and mathematical sciences, and V. V. Khasikov, candidate of technical sciences]

[Excerpt] The growing use in industry and power engineering of the technique of low and extremely low temperatures poses the problem to instrument makers of developing precision transducers to measure and monitor the parameters of cryogenic environments, in particular of pressure. Domestic industry does not produce pressure transducers that operate at low temperatures. The pressure of cryogenic environments is usally measured by transducers located at room temperature and connected to the object by pulse tubes. This method, however, does not provide adequate precision and does not permit measuring pressure in the rotating parts of cryogenic amchines, for example in superconducting generators and engines. The requirement of insensitivity to a magnetic field is usually imposed on highly precise pressure transducers operating in cryogenic machines in addition to high sensitivity, linearity of conversion and low temperature error.

8545
CSO: 1863/32

NEW INSTRUMENTS AND EQUIPMENT FOR AUTOMATION

UDC 651.925.4

SKS 1000-800-2 Blueprinting Machine

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 23

[Text] Designed for reproduction of documentation made on a transparent and translucent basis, by its contact light-sensitive reproduction on roll diazotype light-senstive materials and subsequent development of them by the dry method.

Copy zone width is 1000 mm. Copy speed adjustment range is 30 to 800 m/h. Light source is an arc lamp with no more than 5 kW power. Diameter of glass cylinder is 150 mm. Copies are developed in vapors of ammonia. Speed is continuously adjustable. Roll sheet diazo material is used. Power is 220 V (50 Hz). Power consumption is 12.5 kVA. Dimensions are 1800 x 1500 x 1800 mm. Weight is 900 kg.

The machine is produced by the Lermontov "Orgtekhnika" Pilot Production Plant (Lermontov).

UDC 621.375

KMP201UP1 Automatic Circuit Breaker Amplifier

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 23

[Text] Designed in a set with a polarized realy without self-reset for protection of combined electro-measuring instruments from electrical overloads. Minimum tripping voltage at minimum power supply is no more than 0.6 V. Leakage current at input is no more than 0.02 microamps. Bandpass is no less than 0-20,000 Hz. Output current is no less than 20 mA. Consumption current is 100 microamps. Maximum permitted input voltage is 1000 V. Operating conditions: operating temperature range is from -10 to +50°C. Relative air humidity to 98 percent at 25°C. Atmospheric pressure 86-106 kPa.

Produced by the "Mikroprovod" NPO [Scientific Production Association] (Kishinev).

UDC 621.317.7.085.36

Shch304 Digital Voltmeter

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 23

[Text] Developed to measure constant voltage from 10^{-7} to 500 V under shop and laboratory conditions and to operate in measuring systems. There are two modifications (the single-range Shch304-1 and the multirange Shch304-2) and an extended range of measurement equal to 1.2 of the final value of each subrange: 1, 10, 100 mV; 1, 10, 100 V. During an overload, "12000" is displayed. Resolution at the limit of 1 mV is 0.1 microvolt. Subranges are set by a manual switch. Polarity of voltage being measured is determined automatically. Rate is 25 conversions per second. The instrument has automatic and external starting. Information on the value of the voltage being measured is output in binary-coded decimal; that on polarity is in single position code. There is a visual readout device. Readiness time is 1 hour. Power is 220 V, 50 Hz. Power consumed from main supply is no more than 15 VA. Dimensions: single-range, 61 x 219 x 310; multirange, 70 x 219 x 315 mm. Weight not over 3 kg.

Developed by the "Krasnodarskiy ZIP" PO [Production Association].

UDC 681.613.9

Shch68400 Printer

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 23

[Description by V. I. Shamenko, engineer]

[Text] This device is intended for recording on paper tape information coming from digital metering instruments and other sources of information. It is applied within systems for automatic monitoring of parameters of resistors, stabilitrons, etc. during series manufacturing of them. It is also used in metrological systems for automatic recording of results of checking digital voltmeters.

This printer is among the best produced domestically and meets the requirements imposed on products in the highest quality category.

Specifications

Printing rate	40 lines/second
Number of positions	16
Symbols printed (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, =, -, +, >, <, blank)	16
Pitch between positions	2.54 $\pm$0.5 mm
Pitch between lines	4.$\overline{23}$ $\pm$0.5 mm
Pitch after printed characters	2 + 2.5 mm (in height) 1.3 + 1.6 mm (in width)

Character variation in height in a line	no more than ± 0.5 mm
Dimensions	175 x 380 x 490 mm
Weight	20 kg
Power	220 $V^{+10\%}_{-15\%}$ (50 Hz $\pm 1\%$)
Power consumption	190 VA

The device has a plug-in interface unit and semiautomatic feed of paper tape; it provides display and recording of current time.

It is manufactured by the Nevinnomysskiy Electrical Measuring Instrument Plant.

UDC 681.327

SM-5615 Floppy Disk System

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 24

[Text] This unit is used as external storage for the SM-3 and SM-4 control computers and in data preparation systems. It is designed for recording and storing information on a floppy disk that meets the recommendations of the international standard ISO/TC 97 ACII No 209. The capability of using disks with hard sectoring is provided. The main features of thsi unit are high operating reliability with adequate information capacity and data trasnfer rate; simplicity of servicing and exchange of data media (to the extent of mailing disks); and small dimensions, weight and power consumption. Recording method is two-frequency coding. Interface signals conform to NM SM EVM 010-77. The electronic portion of the unit is made with integrated circuits and discrete components. Circuits for controlling write-reproduction and interface are placed on one standard exchange card. The magentic head is general-purpose with tunnel erasing. The head is moved by a step motor by means of a lead screw.

Specifications

Capacity	3.2M bits
Data transfer rate	250K bits/second
Number of disks	1
Number of usable disk surfaces	1
Operating time to malfunction	10^9 bits/malfunction
Mean time between failures	2200 hours
Dimensions, no more than	230 x 135 x 440 mm
Weight, not over	10 kg

Developed by NIIP (Kiev)

UDC 681.327

SM-5616 Floppy Disk System

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 24

[Text] This unit is designed ro receive and execute commands coming from a processor, exchange data with memory, check the validity of data sent and received, and generate information describing the unit status and conditions under which an operation was completed. Two SM-5616 NGMD [floppy disk storage units] can be connected to a channel for the system of small computers (SM EVM). Data is exchanged with SM-4 and SM-3 control computer memory under software control. The "Common Bus" standard interface is used to attach this unit to the SM-3 and SM-4 control computer complexes. A microprogram controller controls the storage units and data exchange with control computer memory. Microprograms for diagnostics and media formatting have been implemented in the microprogram instruction storage to raise the efficiency of SM-5616 operation. The unit is manufactured as a standalone unit for the UTK SM EVM, second phase. The electronic portion of the unit is made with integrated circuits and discrete components.

Specifications

Data transfer rate	19 bytes/microsecond
Capacity	0.5M bytes (2 x 0.25)
Number of tracks on a disk	77
Number of sectors per track	26
Sector capacity	128 bytes
Average access time	508 ms
Maximum recording density	128 bits/mm
Power required	220 $V^{+10\%}_{-15\%}$ (50 Hz $\pm$1%)
Power consumption	0.5 VA
Dimensions, no more than	354.5 x 480 x 765 mm
Weight, no more than	45 kg

Developed by NIIP (Kiev)

UDC 687.327

SM5603 Floppy Disk System

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 24

[Text] Floppy disk units can be connected to the channel of the system of small computers (SM EVM). Data is exchanged with SM-4 and SM-3 control computer memory under software control. The "Common Bus" standard interface is used to connect this unit to the SM-4 or SM-3. Microprogram controller permits efficient control of the storage units and the data exchange process with minimal hardware costs. Implementation of the principle of distributed data processing yields an increase in the device offline functions and reduces computer time costs. This unit is designed to receive and execute commands from a processor, exchange data with memory, check the validity of data sent and received, and generate information that descibes unit status and the conditions under which an operation was completed. It is a standalone complex unit for the UTK of the SM EVM. The electronic portion of the device is made with integrated circuits and discrete components.

Specifications

Data transfer rate	40K bytes/second
Capacity	0.5M bytes
Numer of program accessible disks	2
Number of tracks per disk	77
Number of sectors per track	26
Sector capacity	128 bytes
Maximum recording density	128 bits/mm
Average access time	300 ms
Power requirement	220 $V^{+10\%}_{-15\%}$ (50 Hz $\pm$1%)
Power consumption, no more than	0.5 VA
Dimensions, no more than	354 x 480 x 765 mm
Weight, no more than	40 kg

Developed by NIIP (Kiev)

UDC 681.327

SM-5211 Magnetic Tape Cassette Unit

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 25

[Text] This unit is used to record and store information on a magentic tape cassette. It can be used in the system of small computers (SM EVM). The parameters of the cassette magnetic tape and the arrangement of information on it correspond fully to the recommendations of the international standard ISO 3407-76. Main features are automatic loading of tape, automatic erasure of defective sections of tape, fast retrieval of files and check reading after recording. It is connected to a control computer complex through standard interfaces in the 2K OSh [common bus] class.

Specifications

Number of SM-5204.01 cassettes	2
Recording density	32 bits/mm
Data transfer rate	1.25K bytes/second
Cassette capacity, not over	450K bytes
Soft error rate	1 x 10^8 bits
Power requirement	220 V $^{+10\%}_{-15\%}$ (50 Hz $\pm$1%)
Power consumption	100 VA

Dimensions: built-in version	177 x 482.6 x 687 mm
instrument version	193 x 1450 x 785 mm
Weight, no more than	30 kg

Developed by NIIP (Kiev)

UDC 681.327

SM-5301 Tape Unit

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 25

[Text] Up to four different types of tape units that have the BVN-1 (nonreturn to 0 with inversion on 1) recording method can be connected to the channel for the System of Small Computers (SM EVM). Data is exchanged with control computer memory in the direct access mode; it is connected to the SM-4 or SM-3 control computers by the "Common Bus" standard interface. Monitoring of the data being processed and functioning of the equipment is provided for in the unit. The SM-5301 consists of the SM-5002 controller and magnetic tape storage units installed in a standard SM EVM rack. The basic version includes two IZOT-5003 or SM-5300 tape storage units. The electronic portion of the unit is made with integrated circuits and discrete components.

Specifications

Data transfer rate	10K bytes/second
Power requirement	$220\ V^{+10\%}_{-15\%}$ (50 Hz $\pm 1\%$)
Power consumption, no more than	1.6VA for the basic version
Dimensions, basic version, no more than	1800 x 600 x 850 mm
Weight, basic version, no more than	245 kg

Developed by NIIP (Kiev)

UDC 681.327

SM-6402 and SM-6402.01 Semiautomatic Plotting Boards for Graphic Information Reading and Conversion

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 25

[Text] These plotting boards are designed to read coordinates of points on graphic images and convert them into digital codes for computer input. They are used within computer-aided design systems; they allow considerable reduction in labor-intensiveness and enhancement of the quality of design and development. Conversion is performed in the discrete and continuous modes. Alpha-numeric, special or control characters are input by using the keyboard and character matrix, organized on the working field of the plotting board. Values of coordinates and number of the point being read can be output to the digital display. Control structure is microprogram; primary processing of graphic information is performed. The units are arranged in a pedestal rack and plotting table with adjustable height and inclination of the working surface. The electronic portion of the units is made with integrated circuits and discrete components.

Specifications

Plotting board working field	850 x 600 mm
Maximum resolution	0.1 mm
Coordinate conversion error	±0.5 mm
Coordinate grid step	variable, accepts values 1, 1.25, 2.5, 5 mm
Coordinate conversion rate: discrete mode	4800 points/hour
continuous mode	100 points/second
Extractor communication with board working field	inductive
Interface type: SM-6402	IRPR
SM-6402.01	OSh
Power requirement	$220V^{+10\%}_{-15\%}$ (50 Hz ±1%)
Power consumption, no more than	470 W
Dimensions: plotting board, no more than	1022 x 960 x 932 mm
control rack, no more than	600 x 750 x 750 mm
Weight, no more than	180 kg

Developed by NIIP (Kiev)

UDC 681.327

SM-6315 Alphanumeric Parallel Printer (ATsPU) and SM-6305 Printer (UV ATsPU)

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 26

[Text] These units are designed to print out alphanumeric and special characters from computers and computer complexes. The SM-6315 ATsPU has the interface for "Radial Connection of Parallel Information Transfer Devices" (IRPR), and the SM-6305 UV ATsPU has the "Common Bus" (OSh) interface. The UV ATsPU can operate as part of an SM-4 or SM-3 control computer complex in the System of Small Computers (SM EVM) under the control of any of the SM EVM operating systems.

There are two versions of the printers: with a media format software control unit (SM-6315.02, SM-6305.02) and without it (SM-6315.01, SM-6305.01)

Specifications

Printing rate	500 lines/minute
Character set	96
Character nomenclature and coding conform to	GOST 13052-74
Maximum number of positions per line	132
Buffer storage capacity in eight-bit words	132

Buffer storage fill time	300 microseconds
Pitch between print positions	2.54 mm
Line spacing (specified by operator)	3.17, 4.23 mm
Paper width	80, 420 mm
Number of printable copies, no more than	5
SM-6315 power requirement	$220V^{+10\%}_{-15\%}$ (50 Hz ±1%)
Power consumption, no more than	600 VA
SM-6305 controller supply from control computer processor (stabilized voltage source), no more than	5 V
Dimensions: SM-6315 ATsPU, no more than	830 x 650 x 1140 mm
controller (two standard exchange cards)	TEZ UTK SM EVM

Developed by NIIP (Kiev)

UDC 681.327

A54310 Display Console

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 26

[Text] This unit is designed for displaying on a CRT screen and editing graphic and alphanumeric information during user interaction with a computer online. It can be used with control computer complexes in the System of Small Computers (SM EVM) and other computers in computer-aided design systems (SAPR), for automation of scientific experiments and research, and in automated control systems. It offers the user broad capabilities for information coding and display and for creating multiconsole workplaces based on it. The unit connects to a control computer complex by the standard "Common Bus" and IRPR interfaces. Data is exchanged with the control computer complex under software control. Data editing and display offline or in a computer system is provided for by the microprogram control unit in the display processor. The console consists of units for control, display with light pen and keyboard; it is arranged in a standard rack and table with display and keyboard. The electronic portion of the unit is made with inetgrated circuits and discrete components.

Specifications

Screen working field	340 x 340 mm
Format of addressable raster (number of points)	2048 x 2948
Brightness levels	3
Time for output of ray to an arbitrary point on the screen	15 microseconds
Average line drawing rate	5.6 mm/microsecond
Character set	96
Character code	KOI-8
Character size	3.8 x 5 mm
Buffer storage capacity	8K 16-bit words
Power requirement	$220V^{+10\%}_{-15\%}$ (50 Hz ±1%)

Power consumption, no more than	2000 VA
Dimensions: rack, no more than	600 x 1800 x 1000 mm
table and display, no more than	838 x 1225 x 670 mm
Weight, no more than	400 kg

Developed by NIIP (Kiev)

UDC 681.323.066

Shch68201 Resistance Comparator

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 26

[Description by A. Yu. Sil'chev, engineer]

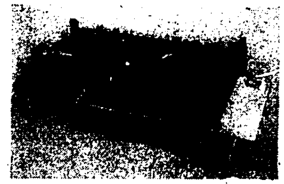
[Text] This comparator is used to determine the relative difference between measured electrical resistance and established calibration resistance and to measure electrical resistance with output of results in digital form on a display and internal recorder.

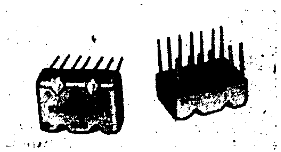
The comparator is an active bridge that converts the relative resistance deviation into voltage and a digital voltmeter that measures this voltage.

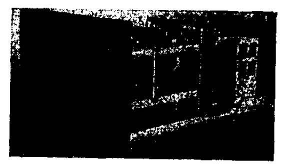
Specifications

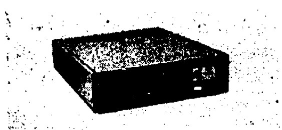
When comparing resistances:	
Measurement limits	1 %, 10 %
Range of comparing resistances	$10 - 10^7$ Ohms
Basic error	0.0005 %
Resolution	0.00001 %
Measuring time (minimum)	0.5 second
When measuring resistances:	
Measurement limits	10, 100 Ohms; 1, 10, 100 kilohms, 1, 10 megohms
Basic error	0.005 %
Resolution	0.0001 %
Measuring time	2 seconds
Power on measured (calibration) resistance	30, 100 mV
Limit selection	manual
Instrument start	manual, automatic, remote
Power requirement	220V $\pm$22
Supply frequency, no more than	50 W $\pm$1
Power consumption, no more than	100 W
Dimensions	130 x 485 x 490 mm
Weight, no more than	20 kg

Developed by SKTB [Special Process Design Office] for information representation facilities (Nevinomyssk).





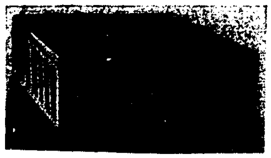


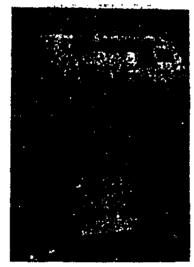


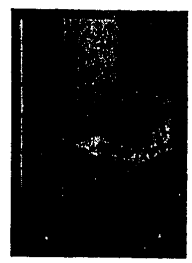
Top: SKS 1000-800-2 Blueprinting Machine
Ctr: KMP201UP1 Auto Circuit Breaker Amp
Ctr: Shch304 Digital Voltmeter
Bot: Shch68400 Printer

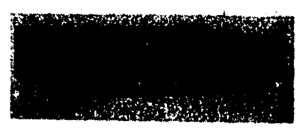
SM-5615 Floppy Disk System
SM-5616 Floppy Disk System

SM5603 Floppy Disk System









Top: SM-5211 Magnetic Tape Cassette Unit SM-6315/SM-6305 Printers
Ctr: SM-5301 Tape Unit A54310 Display Console
Bot: SM-6402/SM-6402.01 Plotting Boards Shch68201 Resistance Comparator

8545

CSO: 1863/32

UDC 681.3.004.1:621.396.6

PROBLEM-ORIENTED COMPLEX FOR MONITORING PARAMETERS OF ELECTRONIC UNITS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 pp 31-32

[Article by E. S. Verdish, candidate of technical sciences, V. V. Zaytsev and M. B. Pisanov, engineers]

[Text] The AKIS (automated monitoring and measuring system) has been developed at the PO LEMZ [Leningrad Electromechanical Plant Production Association] (Leningrad). This problem-oriented complex is designed to automate the processes of monitoring electronic units in numerical programmed control devices (UChPU). The complex has been implemented on a base of the "Elektronika-NTs" microcomputer and made in the standard design of a numerical programmed control device (fig. 1).

The complex with the basic composition of hardware and software permits by a precompiled program sending to the monitored object stimulating (test) signals and feed voltages, measuring the values of parameters of signals output by the monitored unit, comparing actual and permitted parameter values, and sending to the operator and recording information on the check results.

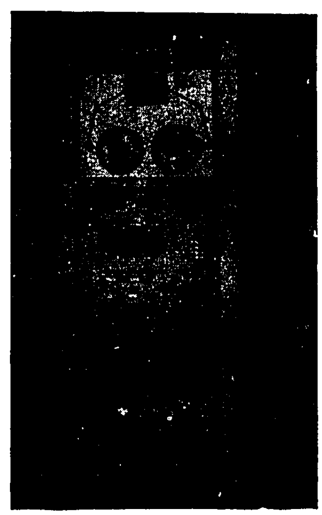


Fig. 1. External view of complex

The structural realization of the complex is based on the modular-bus principle of design which affords regularity of links between the individual modules and also simple adaptation of complex characteristics to additional requirements that occur in expanding the nomenclature of units being checked.

The system architecture is illustrated by the structural diagram (fig. 2). It is controlled by the built-in "Elektronika-NTs" microcomputer with an 8K 16-bit word main memory,

Key:
1. OK [monitored object]
2. A [adapter]
3. GSS1, 2, n [stimulating signal generator 1, 2, ... n]
4. IB1, 2, m [measuring unit 1, 2, ..., m]
5. UPO [object power supply]
6. KB [switching unit]
7. microcomputer
8. Pr [processor]
9. VM [internal bus]
10. KVV [input/output controller]
11. EPM [electric typewriter]
12. PL-150 [tape perforator]
13. AUM [unified bus adapter]
14. KMS [computer communication controller]
15. to computer
16. KFV [photo input controller]
17. UFV [perforated tape input unit]
18. KP [operator console controller]
19. PO [operator console]

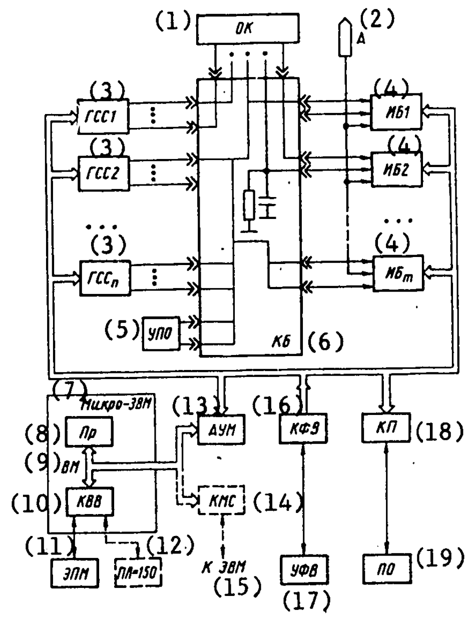


Fig. 2. System structural diagram

The microcomputer is linked to the system units by a unified bus (UM), through which control information and data are sent. The unified bus is joined to the internal bus (VM) for the microcomputer by using a unified bus adapter (AUM).

Connected to the unified bus by means of controllers are the stimulating signal generators (GSS), the measuring units (IB), the perforated tape input unit (UFV) and the operator console (PO).

The electric typewriter (EPM) ("Consul-260") is connected to the microcomputer through the standard input/output controller.

Since the system is oriented to executing a specific group of functions, a specialized operating system was developed for it that permits implementation of the following operating modes upon commands from the operator console (PO):
input to the main memory of the microcomputer of the test program to check the object being monitored (OK);
search for a specific test program on the perforated tape by its number;
one-time execution of the sequence of checks provided by the monitor program;
output of check results in the form of satisfactory or defective to the operator console and printer; and
cyclic measurement of the value of the signal parameter for the selected channel with output of results of measuring to the operator console and printer.

The check series is implemented by swicthing on the stimulating signal generators according to the program and starting up the measuring units for measurement.

Switching the inputs/outputs of the unit being tested with the outputs and inputs of the generators and measuring units is effected by using the replaceable switching unit (KB), which is also used to connect supply voltages to the unit tested and to set the equivalents of output loads.

The basic system includes stimulating signal generators that generate signals with the following characteristics: a sinusoidal voltage of alternating current with a frequency of 100/N kHz, where $1 \leqslant N \leqslant 1999$, and an amplitude of 5 V; a voltage of alternating current of rectangular form with a frequency of 500/aN kHz, where $1 \leqslant N \leqslant 999$ and a = 1, 10 or 100, with an on-off time ratio of 2 and an amplitude corresponding to the TTL levels; a parallel 16-bit code with TTL voltage levels; and single pulses of voltage of positive and negative polarities with a duration of 1 microsecond with TTL voltage levels.

The measuring units included in the basic system allow measuring the following parameters of electrical signals: voltage of direct current of positive and negative polarities within the range of 0 to 50 V with an error no worse than 0.5 percent, within the range of 0.1 to 5 V and with an error no worse than 1 percent in the range 5 to 50 V; pulse width within the range of 1 microsecond to 100 ms; effective value of alternating voltage of sinusoidal form with a frequency of 45 Hz to 100 kHz in the range 0 to 50 V with an error no worse than 1 percent; amplitude of pulse voltage of positive and negative polarity with a frequency of 40 Hz to 100 kHz with a duration of no less than 3 microseconds in the range 1 to 50 V; repetition period of pulse signals of any polarity in the range of 1 microsecond to 100 ms and a frequency in the range 1 kHz to 1 MHz; and the time interval (delay) between the leading edges of two pulses of any polarity coming in through different buses in the range of 1 microsecond to 100 ms.

Provided for in the system is the capability of measuring signal parameters and comparing them to tolerances at internal points in the tested unit by using the single-contact adapter (A) in the one-time or cyclic mode, which allows locating defects in radio elements, microcircuits and printed connections.

An important system feature is the capability of simply adding to its functions by connecting additional software controllable units or standard measuring instruments with digital output, and by including in the operating system program modules that support mathematical processing of measurement results.

Experimental industrial operation of this system indicates that its application to testing electronic units in numerical program control devices yields a four- to fivefold reduction in the labor input to checking operations and rasies the validity of checking.

8545
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UDC 621.382.83

METHOD FOR OBJECTIVE MASS CHECKING OF THROUGH HOLE PLATING IN PRINTED CIRCUIT BOARDS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 pp 35-36

[Article by T. V. Oleynik, engineer]

[Text] The need for research and development of a method of automated nondestructive quality control for plated-through holes in printed circuit boards (PPM) [PCB] has arisen under the conditions of mass production to raise the process throughput while assuring the required precision of measurements, to eliminate subjective mistakes and to raise the validity level.

By PCB plated-through hole quality control, we mean the solution of three problems: detecting voids, pits and cracks in the metallization layer, determining the thickness of the hole plating and checking to ensure contact between the deposited layer in the hole and the copper foil on the PCB. It has been suggested that the first problem be solved by using the fluorescent method [1]. The difficulty lies in the proper selection of the reagent, the luminophor, the properties of which must be technologically comaptible with the process for obtaining the hole plating.

There are several types of instruments based on different principles to measure the thickness of through hole plating. The most suitable in terms of ranges of measured values is the PKM-901 plating inspection instrument. However, it has shortcomings: the checking process is performed manually by using a detached gage, which causes extremely low instrument throughput; also, the possibility of destroying the integrity of the palting is not precluded in the process.

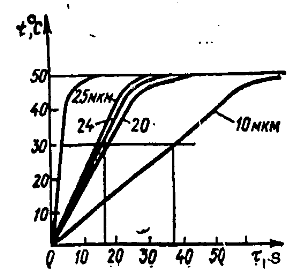
Other devices designed to measure plating thickness, for example, the four-probe and ultrasonic, are also unacceptable due to the considerable difficulty in engineering implementation under the conditions of full automated checking.

Therefore, a compromise has to be found that is free of the deficiencies in the existing methods and that meets the basic requirements imposed on an automated checking system.

One solution to these problems is the use of the thermal method, as indicated by an analysis of checking methods in use [2]. Its essence lies in determining the qualitative and quantitative characetristics of the plating by the variation in the thermal pattern radiated by the PCB plated-through holes. Application of this method has been facilitated by the emergence of highly sensitive radiation detectors that allow finding slight differences in temperatures in the different sections of the surface with adequate precision.

When IK [IR] methods are used, the temperature of the object (the plated-through hole) must be different from that of the background against which it is observed. The required temperature gradient is created by external ecitation of the object, when the heat is transmitted to it by thermal conduction or radiation. In this case, the object temperature begins to rise, and one can judge the parameters of the sample under investigation by its value or time of reaching some threshold value.

In connection with this, one has to study the basic characteristics of substances and the physical processes of heat exchange that flow in the plating layer to detect defects in it based on them.



Heat propagation time for different plating layer thicknesses [MKM = micrometers]

A PCB plated-through hole can be represented in the form of a homogeneous isotropic body with volume V, having an external surface with area S that is in a convective heat exchange with an unrestricted medium, the temperature of which is $t(\tau)$. We have to find the distribution of temperatures $u(x, y, z, \tau)$ within the plating body at any point with coordinates x, y, z at time τ.

The differntial equation for the temperature distribution in the body when there are no energy sources in it is [3]

$$\partial u/\partial\tau = a\Delta u. \quad (1)$$

The heat exchange with the medium occurs according to Newton's law, i.e. boundary conditions of the third type are in effect [3].

At the initial time ($\tau = 0$), all body points have the same temperature, which let us assume equals 0, i.e.

$$u(x, y, z, \tau)\big|_{\tau=0} = 0.$$

To solve equation (1) with the boundary and initial conditions, let us use the operational method based on the integral Laplace transform:

$$F(s) = \int_0^\infty e^{-s\tau} f(\tau)\, d\tau,$$

where $f(\tau)$ is the assumed function, F(s) is the transform of the function $f(\tau)$, and s is the Laplace transform parameter.

Then with regard to the initial conditions, equation (1) will assume the form

$$\Delta U(x, y, z, s) - \frac{s}{a} U(x, y, z, s) = 0. \quad (2)$$

The solution to equation (2) under the boundary conditions can be notated as:

$$U(x, y, z, s) = Y(x, y, z, s)T(s). \quad (3)$$

The expression Y(x, y, z, s) or simply Y(s), in addition to the coordinates x, y, z and parameter s, depends on the internal features of the body (its dimensions, shape, and thermophysical properties of the plating). This expression is called the transfer function for the body temperature with respect to the effect of the medium temperature.

By analogy with mechanical and electrical systems, the transformed medium temperature T(s) can be called the input function, and the transformed body temperature U(x, y, z, s) the output function. Under this consideration, the body under investigation is a unique thermal system that transforms the input value, the medium temperature $t(\tau)$, into the output value, the body temperature u(x, y, z, s).

To simplify, let us replace the transfer function Y(s) by the approximate expression

$$Y(s) = \frac{U(x, y, z, s)}{T(s)} = \frac{1 + \sum_{k=1}^{m} b_k s^k}{1 + \sum_{l=1}^{n} a_l s^l}, \quad (4)$$

where b_k and a_l are expansion factors.

Let us restrict ourselves in expansion (4) to the terms k = 0, l = 0 and l = 1, and then the transfer function will assume the form

$$Y(s) = 1/(1 + a_1 s). \quad (5)$$

Let us find the equation for the transient process, when the medium temperature $t(\tau)$ instantaneously changes from 0 to the value of t_0 and remains constant. Since $T(s) = t_0/s$, then in the first approximation, substituting in equation (3) the expression (5) and changing to the inverse transform $f(\tau)$, we obtain

$$\frac{u(\tau)}{t_0} = 1 - \exp\left(-\frac{\tau}{a_1}\right). \quad (6)$$

The factor a_1 is determined in the process of expanding the precise value of the transfer function by the powers of the parameter s:

$$a_1 = \frac{R^2}{2a} \frac{1+0{,}5\,\mathrm{Bi}}{\mathrm{Bi}},$$

where $a = \lambda/c\gamma$ is the temperature conductivity factor, $\mathrm{Bi} = \alpha R/\lambda$ is the Biot criterion [4] (λ is the thermal conductivity factor, c is the specific heat, and α is the heat exchange factor), and R is the determining dimension.

By expression (6), one can construct the time characteristics of the heat picture existing on the surface of the plating of varying thickness d. Based on calculations, the relationship $t^\circ = f(t)$ was plotted (see the drawing) with the following constant values: $t_0 = 50°C$, $\lambda = 390$ W/m X degree,

$c = 380 \frac{J}{kg \cdot degree}$, $\gamma = 8900\ kg/m^3$, $R = 1.58 \cdot 10^{-3}m$ and $a = 1.153 \cdot 10^{-4} \frac{m^2}{s}$.

Analyzing the curves obtained, one can conclude that the time for heating metallization of different thickness is not identical and varies from one to several tens of seconds. If the temperature t_0 is fixed at a certain level, then according to the time for reaching it, one can judge the thickness of the metallization when the heat is propagated along the plating layer. Thus, for $t_0 = 50°C$, when $\tau = 17$ s, the layer thickness d = 20 micrometers, but when $\tau = 37$ s, d = 10 micrometers.

The results obtained warrant the use of the described principle based on the thermal method for computing the plating thickness. The operation for checking the quality of metallization of the through holes should be included in the PCB production process and performed after the copper electroplating process.

We suggest using as thermal radiation detectors the MF-6 integrated photo detector matrices or the MIF-15 semiconductor photoelectric matrix detectors of radiant energy.

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8545
CSO: 1863/32

UDC 621.383.002.22

MECHANIZATION OF PRINTED CIRCUIT BOARD HOLE CLEANING OPERATION

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 36

[Article by L. N. Samokhin, engineer]

[Text] A unit for washing printed circuit board [PCB] holes by spraying water under pressure has been developed at the Ryazan' PLanning and Technological Institute to optimize PCB production processes, eliminate manual labor and raise the quality of hole plating.

The unit principle of operation consists in water being sprayed under a pressure of 0.8 to 1 MPa that passes vertically through the PCB holes to wash out cuttings and dust formed after drilling and mechanical scrubbing operations.

In the traditional washing method, many jets are installed over the entire width of the transport element so that the water sprays pass through each hole. However, this method requires high water consumption, and thus a high-throughput pump.

In the unit being described, the pump station size has been considerably reduced and the pump is placed within the unit because of the use of two "traveling" jets.

The unit meets the requirement for installability in the process line and has considerably improved washing quality and the capability of using return water.

The unit (see the drawing) consists of the base (6), on which the transport element and washing unit (1) are assembled, and the pedestal (9) that houses the pump.

Wash unit (1) is a bearing assembly, made in the form of a cylinder, rotating on a hollow axle, rigidly secured to a plate. The top cover is made as a pulley, and the bottom flange is used to install and fasten two arms. In the bottom flange, there is also a ring chamber where the water passing through the hollow axle goes. In turn, the chamber is connected to the jets (14) by ring couplings, brass tubes and a rod.

The space between the jets and the board surface is adjustable.

An electric motor (16) rotates the wash assembly. The assembly's rotation rate matches the conveyor rate so that when the board moves a distance equal to the step for drilling holes in a board, the jet will pass over this section at least once.

The availability of two jets rotating on arms will allow, with relatively low pump throughput, affording a good washing of all PCB holes over the entire width of the transport element (3). The latter is made of four roller units that in the aggregate make up seven pairs of take-in/feed and four supporting rollers. The take-in/feed rollers are positioned so that no PCB section is not processed in the washing. The support rollers are used to prevent the board sagging under the water spray.

The take-in/feed rollers are driven by the worm gearing of the transmission shaft (4) that extends through the whole unit.

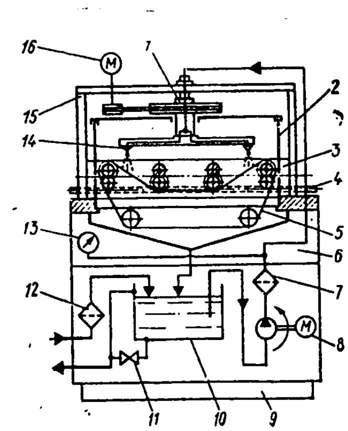

Diagram of unit for washing PCB holes: 5. chain; 13. manometer; 15. frame; other keys are explained in the text

The unit can operate only as part of a modular line, and with that, the torque is transmitted to shaft (4) from the drive module.

The wash assembly and transport element are covered by a hood (2), that along with the base (6) and covers forms the operating chamber. Application of labyrinth seals prevents splash out of the operating liquid (water).

The base bottom is funnel-shaped to collect and drain the used water into the pump station tank (10).

The pump (8) supplies water to the washing assembly. From the tank, the water goes through the inlet pipe, the pump and the outlet pipe to the filter (7), and from there to the washing assembly.

Filter (12) is used for pre-cleaning of the water coming into the tank from the main, and filter (7) is used for fine cleaning of the water before it is fed to the jets.

The unit is controlled by a control unit detached to the line control console.

Specifications

Transport element width	650 mm
Throughput	3 - 30 m^2/hour
Wash assembly rotation frequency	5 s^{-1}
Space between jets and board surface	50-100 mm
Water spray pressure during wash	0.8-1 MPa
Water consumption	0.0015 m^3/hour
Dimensions of boards being processed: maximum	500 x 500 x 2 mm
minimum	150 x 90 x 0.5 mm

Power consumption, no more than	2.9 kW
Dimensions, no more than	862 x 1120 x 1410 mm
Weight, no more than	650 kg

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CSO: 1863/32

UDC 621.383.2.22

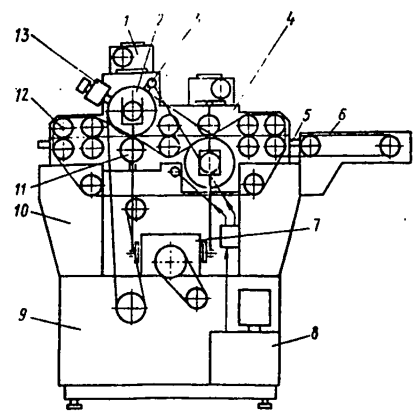
MECHANIZATION OF PRINTED CIRCUIT BOARD SURFACE PREPARATION

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 pp 36-37

[Article by V. I. Klyuyev, engineer]

[Text] In connection with the need of developing and operating specialized lines that implement the final process cycle, new requirements have been imposed on equipment being developed that must be suitable for assembly in lines for various processes. This predetermined the development at the RPTI [Ryazan' Planning and Technological Institute] (Ryazan') of the unit for scrubbing blank printed circuit boards [PCB], module G (model U942).

In contrast to existing models, module G has the following advantages: maximum size of boards to be processed has been extended to 500 mm, the capability of installing the unit in a process line has been provided for, repairability has been improved, the "Akrol" brushes are quickly replaceable, the brushes can be dressed without disassembling them, return water is used, transport element width is 650 mm, the number of brush oscillations depends on the transport element speed governed by the module D drive and is 120 oscillations per minute when the transport element speed is 0.65 m/minute, and the common drive ensures synchronization of line operation.



Unit for scrubbing PCB blanks, module G (model U942):
10. housing; 3. header; other keys are explained in the text

The module G device and the principle of its operation are shown in the drawing. Installed in the base (9) are the pump housing (8), brush drives and oscillator. The pump station, used to supply cooling liquid to the scrub brushes contains the pump (type PA), a sparger for agitating Vienna lime, a check valve, branch pipes for various purposes and a replaceable filter (for coarse filtration).

The brush (2) is a mandrel with a set of resilient scrubbing elements. One end of the brush has a conical mounting surface and two diamteral slots for mounting and locking on a spindle, and the other has a spherical bearing to set the brush on an immobile removable pin.

Installed in unit (4) are take-in/feed rolls to take in, hold and transport boards in the module, bearing supports for the brushes, bearing rollers and mechanisms for aligning and adjusting the clearance between the brush and bearing roller. The oscillating drive of the brushes is effected by reduction gear box (7). Bearing roller (11) is used to rigidly hold the boards on the scrubbing plane. The PCBs are put in and fed to the scrubbing zone (or received after scrubbing) by the transporter (6) with drive from the module.

Dressing mechanism (13) is used for periodic scrubbing of the surface of the brushes without disassembly of them. It is a carriage mounted in two directions (parallel to the take-in/feed rollers, bearing roller and brush working surface). The carriage is driven by turning a knob fixed on a lead screw. The carriage is equipped with a tool (hard alloy, diamond, corundum and others) on a mandrel, that can be discretely moved radially relative to the brush, by which the controlled removal of the necessary layer is achieved.

Adjustment mechanism (1) is used to set the clearance between the bearing roller and the brush working surface. Drive shaft (15) extends through the entire module and is driven by module D (U943).

Operation of the actuating assemblies and mechanisms (brushes, pump, sparger, oscillator) is provided by the control unit, on the face panel of which the controls and an ammeter are mounted. The ammeter is used to monitor the clearance between the working surface and the bearing roller as a function of the scrub brushes drive motor load. The optimal clearance is determined experimentally for a batch of boards: at scrubbing time, the ammeter reading is recorded and board scrubbing quality si checked. Scrubbing is continued so long as the board surface quality meets the process requirements. Thus, the range of the load on the electric motor is established, within which the required scrubbing quality is provided.

The unit operates as follows. A blank board is placed on the canvas of the transporter (6) and is moved into the scrubbing zone for the bottom surface by using take-in/feed rollers (12), and then into the scrubbing zone for the top surface. The rotating brush removes the oxide film from the board surface. At a brush rotation frequency of 1000 rpm and board feed rate of 0.65 m/minute, from 0.007 to 0.015 mm of the layer is removed as a function of the brush pressure force on the boards. Experience indicates that a clearance of 1.1 to 1.2 mm is needed to maintain high quality of scrubbing of boards with a thickness of 1.5 mm

Specifications

Throughput		3-30 m^2/hour
Dimensions of processable blank boards:	maximum	500 x 500 x 2
	minimum	150 x 90 x 0.5
Transport unit width		650 mm
Diameter of scrub brushes		120-90 mm
Brush oscillating movement		8-10 mm
Liquid consumption, no more than		0.5 m^3/hour

Clearance adjustment mechanism scale division	0.0625 mm
Value of one "click" in the dressing mechanism	0.1 mm/rev
Dimensions (without transporter)	562 x 1370 x 1160
Transporter length	6-425 mm
Weight, no more than	750 kg
Pump tank capacity	about 40 1
Power consumption	1.3 kW

8545
CSO: 1863/32

SOFTWARE

UDC 681.3.061

INTERACTION AND PROBLEM MACROPROGRAMMING IN YeS COMPUTER DISK OPERATING SYSTEM

Moscow DIALOG I PROBLEMNOYE MAKROPROGRAMMIROVANIYE V DISKOVOY OPERATSIONNOY SISTEME YeS EVM in Russian 1981 (signed to press 23 Apr 81) pp 2-4, 136-138, 157-161

[Annotation, table of contents, foreword, conclusion, appendix A and bibliography from book "Interaction and Problem Macroprogramming in the YeS Computer Disk Operating System", by S. B. Vekshin, Izdatel'stvo "Nauka", 5000 copies, 161 pages]

[Text] The book describes a disk operating system (DOS) which assures the exchange of information with a programmer during compilation and issuance of tasks, one providing the possibility of operating a computer complex with a minimum set of input-output peripherals, a shortage of main memory in a multiprogram regime and arbitrary variation of priority of the sections. The system permits actively using libraries of initial and object modules to procure information by means of a constructed macrogenerator and performing service functions. It is intended for scientific and technical engineering workers. Tables: 12; illustrations: 16; bibliography: 35 items.

CONTENTS

Preface

At the present time the scientific and technological revolution is posing tasks in the solution of which a need arises to exchange practically instantaneously information between man and machine.

Therefore much attention is now given to the creation of multi-program interactive operating systems for the third-generation YeS computers now very widespread [34,35]. Such systems must simplify and eliminate the adjustment and modification of scientific experimental problem programs, and also programs for the automation of production processes, must allow the application of new progressive procedures during their creation and maximally consider distinctive features of the creative activity of a programmer-developer during communication with a machine. The present book is mainly devoted to description of the interactive system PALLADA, created and introduced by the author at the Institute of Higher Nervous Activity and Neurophysiology of the USSR Academy of Sciences, which facilitates the operation and considerably expands the possibilities of the disk operating system of the YeS computer system (DOS YeS), for the standard YeS DOS system, by virtue of certain of its limitations, proved to be very inconvenient for the organization of operative external control of the computer program in the course of the execution of programs and especially during the debugging of large and complex tasks, a specific feature of which is assuring bilateral exchange of information with an experimental living object, its reception, analysis on a real time scale and control of the object in accordance with the results of analysis.

Although the interactive system was intended originally to solve only such problems, in the process of multiple modifications it acquired a universal character and is completely applicable at any computer center engaged in the development and modification of software.

The main merit of the developed system is the possibility of using a computer with a minimum or limited set of peripherals and a shortage of the main memory in a regime of multi-programming with arbitrary switching of sectional priorities. The formation of a program task in a man-machine interactive regimes, simplicity of work with computer libraries on direct-access devices and the presence of a powerful system microgenerator permits users during the development of program complexes or systems widely used progressive principle of module programming, and also a problem-oriented microlanguage.

The material in the book is arranged so that it can serve simultaneously as educational and reference aids not only for use in the corresponding interactive system but also during operation of the DOS YeS in a scientific research computer center.

A similar account of the original material together with a description of the necessary positions of the DOS YeS, the selection of nontrivial methods of programming and new system macroinstructions developed by the authors on a large number of examples permits hoping that the book will be useful not only to qualified but also to beginning users.

The author feels it his duty to express sincere gratitude and appreciation to N. I. Vekshina, Doctor of Biological Sciences I. A. Shevelev, Candidate of Physical and Mathematical Sciences A. A. Frolov and Candidate of Technical Sciences A. Ya. Dudin, who read the manuscript and made valuable comments on improvement of the procedure in presenting material and also associates of the sections of computer software of the Scientific Research Institute of Electronic Computers, which rendered invaluable consultative help in developing the interactive system.

The author will receive with thanks all the practical comments and suggestions which the readers of the book will consider it necessary to make.

Conclusion

The possibilities of the DOS operating system for YeS computers are still far from exhausted. A stimulus for their further improvement is simplicity of operation, availability, a relatively simple logical structure and economy in comparison with the OS YeS--a complete operating system. Thus the more economic the operating system, the more memory of the computer is devoted to problem programs and they can be more complex while preserving speed of performance on account of exchange with external magnetic disk and tape stores. To learn to control a computer during the operation on it of the DOS YeS system modified by the author is much simpler than during the operation of the OS YeS, but it is little inferior to the latter, thanks to the presence of an internal system microgenerator (absent in the OS), which assures a certain automation of the programming of large and complex tasks through the use of specialized micro-languages, and also an interactive regime for the preparation and adjustment of such tasks. The latter makes it possible to use an interactive system as a system teaching starting programmers to communicate with a computer.

And finally, the main thing, which must not be forgotten, is that the nontriviality of the structure of programs, of the results which can be obtained with their help, will depend completelv only on the people who create them, on their understanding of the machine's possibilities, on the correction of the formulation of the scientific or whatever other task. No matter how powerful it is or what all-enveloping possibilities an operating system has, it still is just an aid in this great and detailed work.

Appendix A YeS Computer DOS Hardware

Item of Equipment	Number
Punched card input device	6012
	6016
Punched card output device	7010
	7012
Table-model typewriter	7070
	7073
	7073A
	7074
	7077
Alphanumeric printer	7030
	7031
	7032
	7033
	7035
Magnetic tape storage	5010
	5012
	5016
	5017
	5019
Magnetic disk storage	5052
	5055
	5056
	5061
Punched tape input device	6022
	7002R
Punched tape output device	7022
	7922P
Data transmission multiplexor	8400
	8401
	8402
	8403
	8404
	8410
Cathode-ray data display tube	7061
	7063
	7066
	BSAN

Item of Equipment	Number
Device not supportable by DOS system, connected to multiplex channel and working in multiplex regime	UNSP
Device not supportable by DOS system, connected in multiplex channel and working in exclusive regime	UNSPB
Device not supportable by DOS system, connected in selective channel	UNSP UNSPB

Devices with the numbers UNSP and UNSPB can be any peripherals meeting the YeS computer standard, for example, graph plotters, graphic displays, an adapter for coupling with a control computer of type ASVT, etc.

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2174
CSO: 1863/107

UDC 62-52.001.2:681.3

INTERACTIVE SUBSYSTEM FOR COMPUTER-AIDED PROCESS DESIGN

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 pp 10-12

[Article by engineers I. A. Gladkov, L. G. Naydich, A. M. Varshavskaya, V. N. Kudryashov, L. A. Zhdanovich and M. B. Bokhan]

[Excerpts] An interactive subsystem for computer-aided process design (ART) that enables a process engineer to interact online with an M-6000 computer using a DM-2000 display has been developed at the "Terminal" Plant (Vinnitsa).

This subsystem includes: DM-2000 display modules installed in the places where the process engineers work, "Consul-260" keyboard printers (UPK), the M-6000 computer operating in the mode of interruptions and enabling simultaneous operation of this and other subsystems, a YeS-5012-01 magnetic tape storage unit, and a set of software and instructions.

The subsystem (fig. 1 [not reproduced]) operates as follows. At his workplace, the process engineer calls the computer through the DM-2000 keyboard. After getting a response, he keys in the codes for the operations and steps needed for the process in a sequence determined by the process path. The code set is sent in the format shown in the diagram to the computer processor through communication channels. The processor reads the table of codes of production operations and steps from the file of classifiers stored in advance on magnetic tape, and checks the set of each code and the presence of it in the classifier. If everything is correct, the display screen shows the text of the production operations and steps in the required sequence according to the form of the process chart, and the columns for needed equipment and tools are filled out. While looking over the process text on the display screen, the process engineer makes additions and refinements in the areas indicated by the cursor, and if necessary, adjusts or repeats the code set. If the process is refined and supplemented, the process engineer keys in the command to print out the process. The print out is made on a process chart form. The subsystem operates jointly with other subsystems upon an interruption and is therefore ready for operation at any time.

The flowchart described above for the subsystem operation algorithm is implemented by the "ART" and "KLASS" programs that were developed in the MNEMOKOD language for the M-6000 control computer system. The program and files take up 10K of storage, but can be reduced to 8K with slight adjustment.

8545
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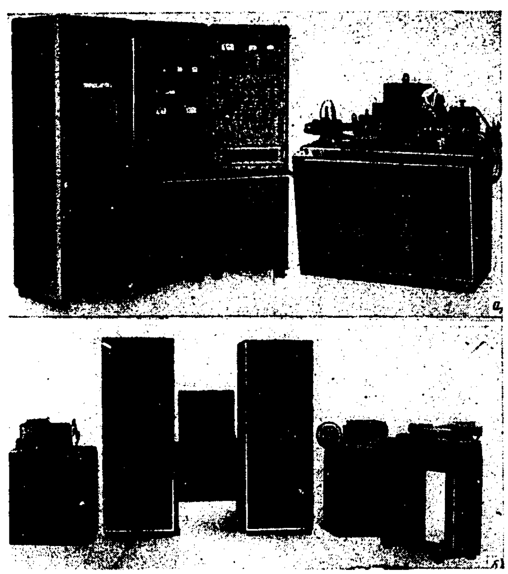
UDC 543.08:621.384

MI-1201B MASS SPECTROMETER

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 31

[Description by N. A. Koval', engineer]

[Text] The MI-1201B mass spectrometer (top photo) is designed for discrete analysis of the isotope composition of gases and solid substances. The large range of measurements by mass numbers and the high resolution allow isotope analysis by the single-beam method for the majority of elements in the periodic system, and by the two-beam method for those elements whose relative difference in isotopic masses is 0.36 to 2 percent. Information coming from a digital voltmeter is processed and the magnetic field is controlled by using the SM-1 basic computer complex (bottom photo).



Specifications

Resolution at level of 10%	1100
Mass range with accelerating voltage of 5000 V	2-720
Argon sensitivity	25 Coulombs/kg
Argon sensitivity threshold	$1 \cdot 10^{-5}$ % by volume
Random component of relative error when measuring with confidence probability of 95% of isotopic ratios:	
^{83}Kr and ^{84}Kr by single-beam method	$\pm$0.15%
^{199}Hg, ^{200}Hg, ^{201}Hg, ^{202}Hg by two-beam method	$\pm$0.08%
Residual pressure in area of ion source	$2 \cdot 10^{-6}$ Pa
Flow rate: of cooling water	0.1 l/s
of liquid nitrogen	$2 \cdot 10^{-4}$ l/s
Power requirement	380/220 V or 220/127 V (50 Hz)
Power consumption, no more than	13 VA
Dimensions, in mm:	
analytic rack	1520 x 1160 x 1360
generation and display racks	700 x 950 x 1690
recording rack	510 x 620 x 1690
SM-1 racks	600 x 850 x 1690
display and stand	600 x 800 x 1250
serial printer	700 x 440 x 940
perforated tape output unit	600 x 650 x 1000
perforated tape input unit	600 x 650 x 945
roughing pump	680 x 380 x 580
Weight of set, no more than	2400 kg

The MI-1201B instrument is delivered upon orders by the "Soyuzglavpribor" VPO [All-Union Production Association] (117218, Moskva, V-218, ul. Krzhizhanovskogo, 16, korp. 1).

8545
CSO: 1863/32

UDC 681.327:534.78

PRIMARY CONVERSION OF SPEECH SIGNAL IN AUTOMATIC SPEECH RECOGNITION DEVICES

Leningrad IZVESTIYA LENINGRADSKOGO ORDENA LENINA ELEKTROTEKHNICHESKOGO INSTITUTA IMENI V. I. UL'YANOVA (LENINA): AVTOMATIZATSIYA PROYEKTIROVANIYA SREDSTV VYCHISLITEL'NOY TEKHNIKI in Russian No 258, 1979 (signed to press 24 Jul 79) pp 57-61

[Article by S. A. Myglan]

[Text] The stage of primary conversion of a complete speech signal (quasianalog, pre-processor processing of the complete speech signal or speech-recognition processing) is objectively necessary because it makes it possible to underline the defined properties of the input complete speech signal (CSS), greatly reduce the volume of the CSS, and thus insure subsequent processing, including identification of secondary characteristics, in the digital block of the autonomous speech signal recognition unit in real time.

Quite a few methods of speech recognition processing have been developed today for recognizing isolated words of a fixed vocabulary [1, 2]. But analysis of these methods for completeness (necessity and adequacy) is difficult because the descriptions of the methods are not consolidated in a uniform classification scheme.

This article gives a generalized methodological scheme for expanding CSS into the minimum essential and complete series of informative primary descriptions (conversions) of the speech signal, based on analysis of a mathematical model of the Markovian random process. The CSS, as a function of sound pressure $p(t)$, converted to electrical oscillations $u(t)$, in view of the conclusions of the acoustic and articulation theories of recognition [3] can be considered a Markovian quasistationary quasiperiodic (semilogarithmic) broad-band random process modulated by amplitude and phase. Such a process, which is finite in the amplitude, frequency, and time domain, may on the basis of [4] be represented by the following mathematical model:

$$u(t) = U(t) \cdot \cos \Phi(t), \qquad (1)$$

where $U(t) = \{u^2(t) + \tilde{u}^2(t)\}^{1/2}$ is the envelope (intensity) of the random process. In this case $\tilde{u}(t)$ is linked with $u(t)$ stationary random process (according to Gilbert); $\Phi(t) = \operatorname{arc\,tg}\{\tilde{u}(t)/u(t)\}$ is the phase of the random process; and, $d\Phi/dt$ is the instantaneous frequency. Considering the conclusion presented in [4, 7], let us formulate several remarks concerning model (1).

1. The possibility of representing the random process of speech formation in the form of model (1) does not impose any significant constraints on the energy spectrum of the process.

2. The most informative frequency range for analysis of the speech signal is the range D_f^p= 100hz - 10 khz.

3. Primary conversion of the CSS in the coordinates "energy-frequency-time" must be done using a definite type of frequency $h(\lambda, \Delta f) = h(\nu)$ and time $h(t-\tau)$ windows of the sliding weighted functions of ongoing speech recognition processing where λ and Δf are the form and width of the frequency window respectively; ν is the generalized parameter of the frequency window; τ is the length of the time window.

Simultaneous separation of two components that are informative from the standpoint of the speech formation process the static component $U(t)$ and the dynamic component $\cos \Phi(t)$ in convolution (1) can be done by means of two parallel filters, each of which suppresses (limits to the maximum degree) the opposite component. Although not a completely compact description (conversion) of the CSS, its spectral-time representation is the most informative form with respect to these two components [5]. In view of what has been stated above and on the basis of [7], the speech recognition procedure for primary conversion of a CSS has the following form:

$$PP = \begin{cases} \bar{u}(t) = \begin{cases} +U_0 \text{ при } u(t) \geq +U_n; \\ 0 \text{ при } u(t) < +U_n; \end{cases} & (2.I) \\ n(t) = \sum_{t=t_0}^{T} d\bar{u}(t)/dt = \sum_{K=1}^{N} \delta(t_0 + t_K); & (2.2) \\ N_{\tau_1}(t) = \sum_{t_0}^{T} n(\tau_1) \cdot h(t-\tau_1) = n(\tau_1)/\tau_1; & (2.3) \\ U_{\tau_2}(t) = \int_{t-\tau_2}^{\tau_2} |u(\tau_2)|^2 d\tau_2; & (2.4) \\ S_{\tau_3}^{i}(f_i, t) = \left| \int_0^t u(\tau_3) \cdot h(t-\tau_3) e^{-j2\pi f_i \tau_3} d\tau_3 \right|, & (2.5) \end{cases}$$

where $\bar{u}(t)$ is the maximally restricted in amplitude (clipped in positive half-plane plane of existence) input signal $u(t)$ (stream of rectangular, constant-amplitude, random-length pulses, with random intervals); $+U_0$ is the standard (unitary) CSS level when the signal $u(t)$ exceeds the threshold level $+U_n, U_n = U^n + \Delta U$; U^n is the noise level; ΔU is a certain added level to distinguish U_n from U^n; $n(t)$ is a random stream of unitary δ-pulses obtained by differentiating $\bar{u}(t)$ with thinning of the even δ-pulses in time; K is the ordinal number of odd δ-pulse, K = 1, 3, 5..., 6N; N is the total number of δ-pulses in the interval T of existence of the CSS; t_0 is the moment of initiation of the speech signal, $t_0 \in T$; t_K is the random time interval of appearance of δ-pulse K; $N_{\tau_1}(t)$ is an estimate of the averaged "instantaneous" density of zeroes (δ-pulses) in the intervals of analysis τ_1; $U_{\tau_2}(t)$ is the intensity of the CSS in the intervals of analysis τ_2; $S_{\tau_3}^{i}(f_i, t)$ is the amplitude of the i harmonic f_i (f_i is the central frequency of resonance filter i), of a component of the m-dimensional spectral vector obtained in intervals of analysis τ_j, that is, the "instantaneous" spectrum.

Thus, the speech recognition procedure presupposes independent and parallel determination of three types of estimates of the form (2.3), (2.4), (2.5) for the CSS. Therefore, we can speak of three types of initial conversion of the CSS making up the speech recognition procedure: type 1, defined by expressions (2.1)-(2.3); type 2, defined by expression (2.4); and, type 3, defined by expression (2.5). In this case an estimate of type (2.3) (speech recognition type 1) is fully informative in problems of identifying the moments of initiation and completion of an isolated pronounced word, identification of acoustic pauses within the word, and identification of sound segments of the CSS (8). The estimate of type (2.4) (speech recognition type 2) gives a measure of both the static and dynamic components of the CSS and is fully informative in problems of identifying vowels (voiced phonemes) and identifying the frequency of the basic tone (pitch-period) of the CSS [5]. The estimate of type (2.5) (speech recognition type 3) is the most informative of the types considered and permits identification of both tonal and noise segments of the CSS on the basis of representation of their fine structure [5, 6]. It should be noted that speech recognition type 1 has a number of additional characteristics in comparison with types 2 and 3, specifically:

1. It achieves invariance of estimates $N_{\tau_1}(t)$ in relation to the changing intensity of the speech signal.

2. It achieves a certain level of noise suppression by maximum amplitude limitation of both the usable signal and noise.

The quantity τ_1, τ_2, and τ_3 in expressions (2.3), (2.4), and (2.5) respectively are determined by the upper syllabic frequency $F_c \approx 30$ hz of the speech sounds (phonemes) and the length of the stationary and transitional segments, the pitch-period of the CSS. In the most common cases of pre-processor processing $\tau_1 = 10$ ms and $\tau_2 = \tau_3 = 20$ ms.

In conformity with (2.1)-(2.5), hardware realization of the quasianalog block for speech recognition processing presupposes the organization of three independent, parallel channels to receive compact information on the CSS and feed it to the digital block of the autonomous speech signal recognition unit, that is, channel 1, 2, and 3 that carry out speech recognition types 1, 2, and 3 respectively. In this case the output of channels 2 and 3 are joined through a commutator and PNK [expansion unknown]. Channels 1, 2, and 3 can be realized using a digital frequency meter [8], an analog integrator based on an RS averager [7], and the comb of three-octave m residence analog filters [6] respectively. In this case, 21 filters are needed to overlap the band D_f^c, in other words $m = 21$. In design terms, this comb can be realized as the series-produced FSP-80 spectrum analyzer and also active series 298 RC-filters using domestically produced microcircuits.

In conclusion we must observe that pre-processor processing of a CSS in the quasianalog block of an autonomous speech signal recognition unit based on the above-described speech recognition procedure is outstanding for its flexibility and universality. It can be realized generally using series-produced assemblies of both analog and digital computer equipment. In this case an estimate of type (2.5) using Parseval's theorem [4] takes on the meaning of various particular methods of primary description of the complete speech signal, for example the format method [5].

FOOTNOTES

1. V. S. Golubtsov, "Methods of Speech Recognition and Synthesis with a Limited Vocabulary," in "Vychislitel'nyye Sistemy" [Computing Systems], Novosibirsk, "Nauka", 1976, Vyp 67, pp 106-135.

2. "Rechevaya Svyaz' s Mashinami. (Tematicheskiy Vypusk)" [Speech Communication with Machines (Topical Publication)], TIIER, 1976, Vol 64, No 4.

3. L. L. Chistovich, "Fiziologiya Rechi. Vospriyatiye Rechi Cheloveka" [The Physiology of Speech. Perception of Human Speech], Leningrad, "Nauka", 1976.

4. B. R. Levin, "Teoreticheskiye Osnovy Statisticheskoy Radiotekhniki" [Theoretical Foundations of Statistical Radio Engineering], Moscow, "Sovetskoye Radio", 1974, Vol 1.

5. M. A. Sapozhkov, "Rechevoy Signal v Kibernetike i Svyazi" [The Speech Signal in Cybernetics and Communications], Moscow, "Svyaz'izdat", 1963.

6. Dzh. Flanagan, "Analiz, Sintex i Vospriyatiye Rechi" [Analysis, Synthesis, and Perception of Speech], Moscow, "Svyaz'", 1968.

7. Dzh. Bendat, and L. Pirsol, "Izmereniye i Analiz Sluchaynykh Protsessov" [Measurement and Analysis of Random Processes], Moscow, "Mir", 1971.

8. G. Tsemel', "Opoznaniye Rechevykh Signalov" [Recognition of Speech Signals], "Nauka", 1971.

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AUTOMATION OF INDUSTRIAL ACCOUNTING AND ANALYSIS INFORMATION PROCESSING

Moscow AVTOMATIZATSIYA OBRABOTKI INFORMATSII PO UCHETU I ANALIZU V PROMYSHLENNOSTI in Russian 1981 (signed to press 14 Sep 81) pp 2, 223-224

[Annotation and table of contents from book "Automation of Industrial Accounting and Analysis Information Processing" by Anatoliy Nikolayevich Romanov, Izdatel'stvo "Finansy i statistika", 7,000 copies, 224 pages]

[Text] Annotation

For the first time, the problems of automating accounting and analysis at the levels of an industrial enterprise (production association) and sector are treated as a unit in this book. Features of organizing systematic processing of information with computers are covered for accounting areas, including automated generation of tabulations for enterprise accounting. The orinciples of computer processing of accounting reports are discussed at the sectorial level of idnustrial management.

This book is intended for specialists on systems for automated processing of economic information and for scientific workers. It can be used by VUZ instructors and students.

Contents

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UDC 658.012.011.56:658.7

TASKS OF AUTOMATED MATERIAL AND TECHNICAL SUPPLY CONTROL SYSTEM IN OKA TERRITORIAL ADMINISTRATION

Moscow MATERIAL'NO-TEKHNICHESKOYE SNABZHENIYE, SERIYA 4: PRIMENENIYE MATEMATICHESKIKH METODOV, VYCHISLITEL'NOY TEKHNIKI I ORGTEKHNIKI V MATERIAL'NO-TEKHNICHESKOM SNABZHENII in Russian No 11, Nov 81 (manuscript received 10 Jul 81) pp 1-5

[Article by G. P. Yesaulova, deputy chief of the Management Department of the ASU for Material and Technical Supply of USSR Gossnab, E. S. Khazanovich, director of the Computer Center of the Oka Central Supply Administration, and S. S. Khivrenko, department chief at the Oka Central Supply Administration: "Tasks of the First Section of the ASU in the Oka Central Territorial Administration of USSR Gossnab"]

[Excerpts] The NIISU [Scientific-Research Institute of Control Systems] and the Oka Central Supply Administration developed, and in November 1980 commissioned, an automated control system for material and technical supply in the Oka River area. The development of the ASU in the Oka Central Territorial Administration was regarded as a model element in the ASU of USSR Gossnab, which is why most of the problems and subsystems were oriented on model project solutions (TPR) and standard programs.

The first section of the ASU includes the following functional subsystems: determination of demand for products, drawing up balance sheets and distribution plans, establishment of economic ties, monitoring deliveries, control of reserves of material resources, planning and fiscal activity, bookkeeping and accounting, control of cargo handling processes. Each subsystem consists of problems sharing a common economic essence and utilizing the same data software. The basic elements of the system's hardware are two ES-1022 computers.

For the convenience of users, a system of output of data about stock inventories on display terminals was developed. On the suggestion of users, during the solution of the task of recording and controlling aggregate stocks on the basis of statistical report forms 1-SN and 2-SN, work was done to rearrange the column widths in all ledgers. To assure control over violations of fiscal discipline by construction organizations, provisions have been made to add a new column to outgoing ledgers: "Supply of products to enterprises and organizations of other ministries (departments) on their orders". Reports on the movement of products in the most important products lists are forwarded to the USSR Gossnab; therefore, to reduce the labor needed to prepare this information provisions have been made for its output on punched tape.

Introduction of the ASU of the Oka Central Territorial Administration on the basis of the Unified Computer System began in conditions when the Computer Center was already using "Minsk-22" computers for solving a sufficiently wide range of problems for all the Central Administration's specialized administrations. This necessitated the solution of a number of problems involving the transition to new hardware incompatible with that formerly used. The transition is proceeding normally thanks to detailed planning of efficient sequences of problem input, transfer of information files from computer to computer, and of the sequence of selecting the units to be transferred to the new unified products classifier. All computer centers going over to the use of the Unified Computer System will face similar problems in one form or another.

Much attention was given to questions of the authenticity and completeness of the data processed by the Unified Computer System, and control over data input and transmission from the users to the computer center and back has been considerably enhanced. An important prerequisite for this was the replacement of formal methods of control (of the correspondence of the computer medium to the document) with control of the correctness of reflection of the economic operation in the document itself by logically comparing individual elements of the information files (commodity code and listed price, planned and actual delivery, etc.).

The estimated economic effect deriving from the introduction of problems of the first stage of the ASU of the Oka Central Territorial Administration is 545,700 rubles.

The main factors of economic effectiveness are: timely supply of consumers with material resources, drawing extranormative territorial resources into the economic turnover, acceleration of turnover of working capital, reduction of the labor-intensivity of data processing, and streamlining the management of material and technical supply. Some of the tasks of the described system are currently being duplicated in a number of organizations of the USSR State Supply Committee.

Address for information: Priokskglavsnab, 79 Prospekt Lenina, Tula.

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UDC 658.815:[681.32.06:519.688]

'CONTROL OF PRODUCTS SUPPLY' COMPLEX OF PROBLEMS IN AUTOMATED CONTROL SYSTEM FOR MATERIAL AND TECHNICAL SUPPLY OF MOLDAVIAN SSR

Moscow MATERIAL'NO-TEKHNICHESKOYE SNABZHENIYE, SERIYA 4: PRIMENENIYE MATEMATICHESKIKH METODOV, VYCHISLITEL'NOY TEKHNIKI I ORGTEKHNIKI V MATERIAL'NO-TEKHNICHESKOM SNABZHENII in Russian No 12, Dec 81 (manuscript received 20 Aug 81) pp 1-2

[Article by I. I. Ochichenko, deputy director of the Computer Center of Moldavian SSR Gossnab, and V. P. Polun, department chief at the Computer Center of Moldavian SSR Gossnab]

[Text] The computer center of Moldavian SSR Gossnab has developed a complex of problems, "Control of Product Supply", using the "Minsk-32" and ES-1022 computers, which is being introduced in subordinate organizations of Gossnab. The problems include:

drawing up plans of supply of products to warehouses of Moldavian SSR Gossnab and customers in the republic by the warehouse and transit forms of delivery;

control of deliveries of products from wholesale bases of Moldavian SSR Gossnab;

control of transit deliveries of products to customers in the republic (for organizations participating in customer-supplier accounts);

control of the meeting of contract commitments for warehouse deliveries to customers in the republic;

preparation of acceptance invoices for transmittal to warehouses in the system of Moldavian SSR Gossnab.

According to the accepted classification of problems, the first and last problems are not directly connected with delivery control and were included in the complex because they have no independent significance or are ineffective separately from it. The five basic output forms obtained in the problem complex correspond to forms developed by the computer center of the "Mosgormetallosnabsbyt" [Moscow City Metals Supply and Sales organization] and recommended for introduction at all computer centers in USSR Gossnab system.

The other four basic output forms and the principal part of the project were developed independently. In particular, the forms include a "Ledger of Funds Realization" for groups of fund-holders (warehouse and transit deliveries) and a "Ledger of Products Deliveries to the Republic" according to suppliers (warehouse and transit deliveries) classified in groups.

The complex's software includes four load modules (programs) in the input language COBOL of the "Minsk-32" computer. The primary information is punched in according to two basic patterns (data on delivery plans and information about suppliers' payment requirements). The classifiers provide for all attributes needed for the functioning of planning problems, bookkeeping and accounting, etc., and are therefore common for the whole system. Incoming information is processed at the computer center and fed into the computer daily as it arrives.

The project was tested in the Moldmetallosnabsbyt [Moldavian Metals Supply and Sales] Administration and is currently being introduced in the Moldtara [container] and Moldpriborsnabsbyt [instrument supply and sales] administrations. In the latter, data processing is done on an ES-1022 computer and the software is packaged in the Unified System's operating system.

Address for information: VTs Gossnaba Moldavskoy SSR [Computer Center of Moldavian SSR Gossnab], 19 Petrikanskaya St., Kishinev 277031.

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UDC [656.225:665.733]:[65.012.2:681.32]

NONUNIFORMITY FACTORS IN TRANSPORTATION PLANS

Moscow MATERIAL'NO-TEKHNICHESKOYE SNABZHENIYE, SERIYA 4: PRIMENENIYE MATEMATICHESKIKH METODOV, VYCHISLITEL'NOY TEKHNIKI I ORGTEKHNIKI V MATERIAL'NO-TEKHNICHESKOM SNABZHENII in Russian No 12, Dec 81 (manuscript received 24 Aug 81) p 9

[Article by V. G. Karchik, docent at LIIZhT (Leningrad Institute of Railroad Transportation Engineers) and B. P. Nemtsov, LIIZhT senior research associate]

[Text] The Leningrad Institute of Railroad Transportation Engineers has an assignment from the Soyuzglavneft', [Petroleum] Administration of the USSR Gossnab to streamline the transportation of petroleum products. An analysis of monthly operational production plans revealed considerable variations in them. The greatest changes in the formation of assortment programs occur in planning the production of grade A-72 motor gasoline. ES-1033 computers were used at the Computer Center of the Oktyabr'skaya Railroad to estimate 17 optimal plans according to monthly plan indices: 12 monthly, four quarterly and one annual. A comparison of the actual and optimal operational plans for A-72 gasoline revealed that the mean haulage distance [MHD] varies considerably from month to month according to changes in production plans.

Thus, in June the actual MHD was 1.7 times higher than in November and December. Changes in assortment programs lead to an even greater increase in the MHD of gasoline. In this connection we think it necessary to have a numerical estimate of the effect of the nonuniformity of monthly transportation plans on the MHD. For this we drew up optimal quarterly and annual transportation plans in which the nonuniformity of operational planning was eased by summing over the volumes of resources and consumption month by month.

The easing of the monthly nonuniformity of plans of refining grade A-72 gasoline will lead to a reduction in the freight turnover of railroad transportation by 489,000,000 t/km, which in cash terms would mean a reduction in transportation costs of 1,500,000 rubles per year.

Address for information and requests: Department of Transportation Economics, LIIZhT, 9 Moskovskiy Prospekt, Leningrad 190031.

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UDC [681.518.22:658.7](437)

AUTOMATED INFORMATION SYSTEM OF SUPPLY AND SALES ORGANIZATION

Moscow MATERIAL'NO-TEKHNICHESKOYE SNABZHENIYE, SERIYA 4: PRIMENENIYE MATEMATICHESKIKH METODOV, VYCHISLITEL'NOY TEKHNIKI I ORGTEKHNIKI V MATERIAL'NO-TEKHNICHESKOM SNABZHENII in Russian No 11, Nov 81 (manuscript received 30 Jul 81) pp 14-15

[Review by L. I. Rubleva of an article from VNEDRENIYE NA PREDPRIYATIYAKH AVTOMATIZIROVANNYKH SISTEM UPRAVLENIYA, No 7, 1981 (Express Information of TsNIITEI Goskomsel'khoztekhniki SSSR [Central Scientific-Research Institute of Technical and Economic Information of the USSR State Committee for Farm Machinery])]

[Text] The organization "VHI Zbroyovka" (Czechoslovakia), which engages in supply and sales of farm machinery, has introduced a dialogue-type automated information system (AIS).

The inventory of the supply and sales organization includes 120,000 items (farm machines and spare parts for them). It has 800 suppliers and 10,000 customers. The organization has 120 wholesale centers with a network of warehouses, which handle some 25,000 sale operations daily. Every year the organization concludes some 1,500 contracts for the supply of products, with the number of items reaching 200,000.

The AIS hardware includes an ICL 4/50 computer with an internal storage capacity of 256 kbytes and an external storage capacity of 4X60 Mbytes. In the future, as the AIS develops, a network of local terminals will be added for real-time processing of current information. Data recorded by the indexed-sequential method are stored on a magnetic disk. The body of data is currently 200 Mbytes and will subsequently be increased to 400-600 Mbytes.

All the AIS software is recorded in the algorithmic language COBOL and has a module structure. The IDMS system was adopted as the universal software for controlling the data base as being the most suitable one for the requirements of the AIS. In future the IDMS system will also most likely be used with machines of the Unified System of Electronic Computers.

The central data base of the AIS comprises the following indexed-sequential data sets: price-list of products, list of farm machines, directory of commercial outlets, directory of customers and suppliers, business contracts, items in business contracts divided by quarters, contacts between suppliers and customers, warehouse stocks and their movement.

Successful introduction of the AIS was facilitated by the following distribution of responsibilities during its development and introduction: designing the system as a whole, designing the data base, elaborating specifications, analysis and programming methods, coordination of designing work and normative control, adjustment and tuning up the AIS to optimal operating conditions.

The development of the AIS began in 1976 and it was ready for industrial operation in the 2nd quarter of 1980.

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PERSONALITIES

PSHENICHNIKOV CONGRATULATED ON HIS 60TH BIRTHDAY

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 p 15

[Text] Aleksandr Matveyevich Pshenichnikov, doctor of engineering science and director of the department of remote control at the State All-Union Central Scientific Research Institute of Integrated Automation (Moscow), has celebrated his 60th birthday.

Aleksandr Matveyevich has devoted 37 years of his working life to remote control. To a large extent, he is responsible for the successful development of this area of technology and its becoming a major subsector of the instrument making industry.

Based on comprehensive theoretical and experimental research, he developed the major principles for design of the optimal structures and selection of the basic parameters for remote control devices from a consideration of the features of the objects of their application, configuration of communication channels and statistical characteristics of information flows.

The NART-67 (second generation), ASTT-1 (third generation) and ASTT-2 (fourth generation) modular remote control systems were developed and placed in series production under his direction and with his creative participation.

Aleksandr Matveyevich is in the prime of his creative life and with his group of associates is continuing to work on improving and expanding industrial output of modern remote control equipment.

This journals editors and staff congratulate Aleksandr Matveyevich Pshenichnikov on his birthday and wish him health, happiness and further creative success.

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PRIZES AWARDED FOR SCIENTIFIC RESEARCH INSTRUMENTS AND SYSTEMS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 81 pp 44-45

[Article by T. N. Ryzhova, instructor, Central Board of the Scientific and Technical Society of the Instrument Making Industry, "Competition Results"]

[Excerpt] The Central Board of the Scientific and Technical Society of the Instrument Making Industry imeni Academician S. I. Vavilov has approved the results of the annual competition for the S. I. Vavilov prizes for development of instruments, units and systems for scientific research for 1980.

Participating in the competition were author groups from a number of research and development organizations, industrial enterprises and VUZ's engaged in instrument development for scientific research.

First prize was awarded to the author group (I. Ya. Shtral', S. Ye. Aronina, P. K. Cherednichenko and V. I. Timoshenko, Experimental Design Office for Automation, "Khimavtomatika" NPO [Chemical Automation Scientific Production Association], Moscow) for the "Basic Software and Hardware System for Automating Chemical Process Research Systems" (BPTK).

Developed in this complex for the first time is a series of standard units and modules designed to develop specific automated systems for all types of chemical process research: from kinetics on the molecular level to the efficiency of process solutions on fragments of the technological process. In the development of the complex, the ideology of the international modular CAMAC system was extended for the first time to an electropneumatic system. The complex supplements the state system of instruments and computer hardware in the area of parameters specifically for chemical process research, including mini and micro flow rates, and it permits analyzing local characteristics of corrosive and dispersive media and measuring nonstationary phyisicochemical parameters. The complex permits solving the following problems by using computer hardware: creating flows of matter and energy in objects as well as controlled disturbances (software control), stabilizing and monitoring the operating mode, monitoring object response to disturbances, recording information, performing proximate analysis of experiment results, solving primal and inverse problems of modeling the process being studied, planning and evaluating experiments and performing discrimination of hypotheses advanced by the researcher in the form of models of the process being studied.

The modular design of the complex provides the capability of online acquisition and reconfiguration of a system for performing research on a broad class of chemical processes, which is feasible because of the use in the Basic Software and Hardware System for Automating Chemical Process Research Systems of common standardized hardware, interactive software systems at all levels, and computer hardware in a unified hierarchical system

Second prizes were awarded to author groups at the Special Design Office for Gas Chromatography at the Moscow "Manometr" PO [Production Association] (V. M. Poshemanskiy, V. N. Chernyakin, V. I. Romanov, A. E. Ventsel' and M. A. Kurtsman) for the work "'Khrustal' 5002' Chromatograph" and at the Moscow Institute of Electronic Control Machines (S. N. Khrushchev, S. S. Partsevskiy, V. N. Pokudov, V. P. Khomyak and A. A. Marchuk) for the work, "Development and Introduction into Series Production of the IVK-2 Measuring-Computing Complex." They were accomplished at a high scientific and technical level, are original and have made a substantial contribution to the development of science and technology.

The "Khrustal' 5002" chromatograph is a general-purpose fully automated instrument designed to perform selective highly sensitive analysis of five classes of organic compounds in a broad range of concentrations. The chromatograph has 40 models differing in the set of detectors, facilities for automation of analysis and those for automatic information processing. Gas chromatographic analysis can be performed with the "Khrustal' 5002" chromatograph at temperatures to 450°C, which also extends by far the capabilities of the instrument compared to similar domestic and foreign chromatographs. The instrument has extensive application in performing scientific research in the field of the environment in various sectors of the national economy.

The IVK-2 measuring-computing complex is a problem-oriented complex of the SM EVM [System of Small Computers] and was developed to automate scientific experiments performed by general physical methods. Application of the complex in systems for automation of scientific experiments allows a considerable enhancement in quality and reduction in time for completing the experiment and affords the capability of qualitatively new types of experiments to study and research rather complex objects. The complex effects reception, recording, processing and output of experimental information in real time. The modular design of the complex allows the user to modify the configuration of the complex applicable to the experiment. The basic software includes standard operating systems, programs for operating with CAMAC devices in a high-level language, and test and metrological software. The IVK-2 complex has been assimilated and is in series production by the Kiev "Tochelektropribor" PO [Production Association].

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PUBLICATIONS

UDC 681.32

ABSTRACTS FROM JOURNAL OF LENINGRAD ELECTRICAL ENGINEERING INSTITUTE

Leningrad IZVESTIYA LENINGRADSKOGO ORDENA LENINA ELEKTROTEKHNICHESKOGO INSTITUTA IMENI V. I. UL'YANOVA (LENINA): AVTOMATIZATSIYA PROYEKTIROVANIYA SREDSTV VYCHISLITEL'NOY TEKHNIKI in Russian No 258, 1979 (signed to press 24 Jul 79) pp 2, 99-103

[Annotation and abstracts from collection "News of the Order of Lenin Leningrad Electrical Engineering Institute imeni V. I. Ul'yanov (Lenin): Automation of the Design of Computer Resources", edited by Professor A. V. Plotnikov et al., Redaktsionno izdatel'skiy otdel LETI, 300 copies, 103 pages]

[Text] Annotation

The articles published in this collection present the results of theoretical and experimental studies made by associates and graduate students in the department of computer technology of LETI [Order of Lenin Leningrad Electrical Engineering Institute imeni V. I. Ul'yanov (Lenin)].

The articles consider the questions of development and use of computer resources and the automation of design.

Professor A. V. Plotnikov is responsible for publication of the collection of articles. The editorial board is composed of professors V. B. Smolov, A. V. Plotnikov, and V. V. Barashenkov.

UDC 681.3.06

THE POSSIBILITIES OF LOADING A LIST-PROCESSING SYSTEM IN THE MEDIUM OF THE DOS AND OS

[Abstract of article by Razumovskiy, G. V.]

[Text] This article considers questions of linking a list-processing system with the YeS EVM [Unified System of Computers] DOS [Disk Operating System] and OS [Operating System]. Ways of including the list-processing system in programming languages are analyzed. The structural diagram of the list-processing system is given. The article has one illustration and one bibliographic entry.

UDC 51:155.001:57:681.3.06

THE THEORETICAL SET APPROACH TO DEFINING PROCEDURES FOR IDENTIFYING THE CONTOUR AND SKELETON OF AN IMAGE

[Abstract of article by Kokayev, O. G., and Toybina, M. I.]

[Text] The authors propose formal procedures for eliminating information redundancy in graphic images by identifying the contour and skeleton of the image. The information redundancy of the images is achieved by obtaining the property of nontransitoriness in the linkage relationship, assigned in a set of blackened points of a discrete grid, for pairs of points. The article has two bibliographic entries.

UDC 681.326.3

THE TASK OF DESIGNING SPECIALIZED MULTIMICROPROCESSOR SYSTEMS

[Abstract of article by Belov, V. G.]

[Text] This article considers methods of distributing statements and memory of the computing process over microprocessors and memory elements of a multimicroprocessor system for the purpose of minimizing equipment costs. The article has three bibliographic entries.

UDC 681.326.3

DESIGNING STORAGE CONTROL UNITS IN MODULES OF A REGULAR MULTIFUNCTIONAL COMPUTING SYSTEM

[Abstract of article by Surovyagina, L. A. and Timofeyev, A. O.]

[Text] The authors point out the wisdom of realization by program means of the algorithm for the functioning of units that control external storage. The article considers microprogram realization of the necessary operations by an automatic device based on one type of MRVS [expansion unknown] modules. The article has three illustrations, one table, and two bibliographic entries.

UDC 681.327

SURVEY AND SOME MEANS OF TECHNICAL REALIZATION OF MICROPROGRAM COMPUTER SYSTEMS

[Abstract of article by Bil'gayeva, N. Ts.]

[Text] This article describes the characteristics of several generations of microprogram systems. It reviews methods of technical realization and the characteristics of certain existing microprogram systems. There are five tables and one bibliographic entry.

UDC 681.325

ONE APPROACH TO SELECTION OF MICROPROCESSORS

[Abstract of article by Fedin, A. L.]

[Text] This article presents a comparison of the known methods of describing microprocessors. It considers an approach which makes it easier to select a microprocessor in the early stage of designing microprocessor systems and permits automation of this stage of design.

UDC 681.355.8

ONE METHOD OF COMPUTING THE FUNCTIONS OF AN INDEPENDENT VARIABLE IN A SPECIAL-PURPOSE COMPUTER

[Abstract of article by Rzheutskaya, S. Yu., and Svin'in, S. F.]

[Text] The authors review methods of approximating functions in a special-purpose computer by expansion to a Fourier-Walsh series and expansion by integrals from Walsh functions. The article describes the structure of an extrapolating approximator. The advantages of such a device are noted. The article has one illustration and two bibliographic entries.

UDC 512.8+681.32.068

DETERMINING THE COMPATIBILITY OF SYSTEMS OF LINEAR INEQUALITIES

[Abstract of article by Zuyev, I. S.]

[Text] The author investigates the question of finding effective algorithms for testing the compatibility of systems of linear inequalities. He shows the possibility of using the simplex method of linear programming to solve this problem. The article proves a theorem that makes it possible to substantially broaden the class of problems of compatibility of systems of linear inequalities that are soluble by means of the simplex method of linear programming. The article has three bibliographic entries.

UDC 681.325.34:519.65

COMPARISON OF TWO METHODS OF CONSTRUCTING FUNCTIONAL CONVERTORS WITH SEVERAL INPUTS

[Abstract of article by Dokuchayev, A. A., and Zentsov, V. A.]

[Text] This article compares two methods of constructing functional convertors with several inputs. Calculations performed on a computer show that the method based on approximation of the initial functional dependence of elementary functions on the same number of independent variables should be used. There are three illustrations and two bibliographic entries.

UDC 681.325.3:621.25

READ-ONLY MEMORY IN DEVICES TO ENCODE CYCLICAL CODES

[Abstract of article by Volkogonov, V. N.]

[Text] The author reviews questions related to the construction of devices to encode cyclical codes based on read-only memory. The article demonstrates the possibility of using the method of functional decomposition during development of the encoder. The article has two illustrations, two tables, and five bibliographic entries.

UDC 621.391:681.3

PROBLEM-ORIENTED LANGUAGE TO DESCRIBE THE MICROSTRUCTURE OF GRAPHIC IMAGES FOR AUTOMATIC INPUT OF DRAWINGS TO A COMPUTER

[Abstract of article by Bronnikov, V. A.]

[Text] This article reviews the syntax and semantics of a language to describe the microstructure of graphic images. The author gives an example of analysis of a refined image and the tree of syntactical analysis in terms of the description language introduced. There are three illustrations and eight bibliographic entries.

UDC 681.327:534.78

ON THE QUESTION OF PRIMARY CONVERSION OF A SPEECH SIGNAL IN AUTOMATIC SPEECH RECOGNITION DEVICES

[Abstract of article by Myglan, S. A.]

[Text] The article presents a generalized methodological scheme for expansion of a speech signal into the minimum essential series and a complete series of informative primary descriptions. The scheme can be realized in a quasianalog block for preprocessor processing of a speech signal. The article has eight bibliographic entries.

UDC 681.3.068

ORGANIZATION OF A SYSTEM OF APPLIED PROGRAMS FOR AUTOMATING THE DESIGN OF MICROPROGRAM AUTOMATA

[Abstract of article by Gur'yanov, L. V.]

[Text] The author proposes a way to organize a system of applied programs to automate the design of microprogram automata based on the operating system of BESM-6 computer, which has the capability of expanding software and adapting to the qualifications of the user. The article has one illustration and 10 bibliographic entries.

UDC 681.32-181.48:621.9.06-529

MICROCOMPUTER SOFTWARE IN DIGITAL PROGRAMMED CONTROL UNITS

[Abstract of article by Belova, T. M., Simakov, A. L., and Khokhlovskiy, V. N.]

[Text] This article discusses questions of designing the internal and external software of microcomputers in digital programmed control units. The authors consider a possible hierarchy of levels of automation of microcomputer programming in digital programmed control units. The development of a debugging program for a domestic microcomputer is considered. The article has two illustrations and four bibliographic entries.

UDC 62.507

MINIMIZING THE NUMBER OF REPETITIVE STATEMENTS IN THE LOGICAL CIRCUITS OF ALGORITHMS

[Abstract of article by Gur'yanov, L. S.]

[Text] This article describes two ways of consolidating statements in logical circuits of algorithms that have the same name but are not equivalent. The author proposes appropriate algorithms to convert the logical circuits and evaluates the complexity of the resulting logical circuits of algorithms. The article has three illustrations and seven bibliographic entries.

UDC 621.391.2

SELECTING DISCRETIZATION INTERVALS IN MULTICHANNEL UNITS TO ESTIMATE SIGNAL PARAMETERS

[Abstract of article by Makulov, V. B., Plemyannikov, A. K., and Romantsev, V. V.]

[Text] This article investigates the influence of the size of the discretization interval on the noise suppression of units to estimate the non-energy parameters of signals against a noise background using the rectangular function of losses. The article has four bibliographic entries.

UDC 681.325

THE ORGANIZATION OF MODELS OF MICROCOMPUTERS

[Abstract of article by Kukushkin, B. A.]

[Text] This article reviews the principles of constructing a three-level model which enables any distinct part of a microcomputer (the object of modeling) to be considered on the logic level or the functions level. The article has nine bibliographic entries.

UDC 681.327.17

METHOD OF IMPROVING THE RELIABILITY OF DEFECT-HUNTING DEVICES IN SINGLE-OUTPUT DISCRETE OBJECTS

[Abstract of article by Kalyavin, V. P., and Nikiforov, S. N.]

[Text] The article proposes reducing the degree of distortion introduced by defect-hunting means by modifying the interconnection module of the register in which the values of the reactions of the object being diagnosed are stored. The output is the analytic dependence of the probability of failure to discover defects on the bit configuration of the register. The article has one illustration and two bibliographic entries.

UDC 681.3.192

ONE ADVANTAGE OF UNITARY CODING OF THE STATES OF A CONTROL AUTOMATON

[Abstract of article by Tolbast, B. B.]

[Text] This article reviews a technique of reserving in a control automaton without functional division of the primary and reserve equipment. The advantage of unitary coding of states is demonstrated.

UDC 519.714.71:681.3.069

APPROXIMATE ALGORITHMS FOR MINIMIZING SYSTEMS OF BOOLEAN FUNCTIONS

[Abstract of article by Gubkin, A. F., and Broudo, A. M.]

[Text] This article proposes four machine-oriented algorithms for minimizing systems of boolean functions. The initial form of assignment of the system of boolean functions is a random disjunctive normal form (DNF). The authors propose two forms of representing the system of boolean functions in a random DNF. The algorithms described realize methods of minimization based on division of the system of boolean functions. The algorithms are realized on a BESM-6 computer.

11,176
CSO: 1863/81

DATA PREPARATION IN COMPUTER CENTERS

Moscow PODGOTOVKA DANNYKH V VTs in Russian 1981 (signed to press 31 Mar 81) pp 2-5, 12, 28-29, 51, 109-116, 188-192

[Annotation, introduction, excerpts, bibliography and table of contents from book "Data Preparation in Computer Centers" by Aleksandr Aleksandrovich Ivanov, Izdatel'stvo "Finansy i statistika", 8800 copies, 192 pages]

[Excerpts] This book represents the first systematic presentation of the practical principles for preparing data oncomputer information carrying media and is devoted to this most important and responsible stage in the production process in computer centers, on which depends the quality and timeliness of the output of resulting information. The book covers major issues related to the work of operators and technicians on various devices of the YeS EVM (Unified System Computer) and "Minsk-32" computer.

For the first time, the fundamentals for data preparation and checking on magnetic media using devices and systems of the types, SPD (Automated Data Preparation System)-9000, YeS-9001, YeS-9002, YeS-9003, YeS-9004, YeS-9006, YeS-9112, YeS-9112c, YeS-9150 and SPD-9000M are presented.

This book may be helpful in the training of operators and technicians for computer centers and also may contribute to correct understanding on the part of planners.

Introduction

At today's stage of development, the mechanization and automation of production on the basis of wide use of modern computer technology is becoming more and more important. Analysis of the practices involved in the design and operation of computer centers and collective use computer centers testifies to the fact that the greatest bottleneck in the technological mode of operation of information processing is the preparation and checking of data on computer information carrying media.

If, in the process of development, computers have gone through four generations, from vacuum tube computers to large-scale integrated circuit multiprocessors which make it possible to handle tens of millions of operations a second, then the preparation and checking of data on perforated media have lagged behind them to a significant degree. At the present time, devices and systems are being developed for preparing and checking data on magnetic tape. This tape will be ready for direct input into the computer at a rate more than ten times faster than data input from traditional punched cards and tape.

Such developments are going on in our nation, as well as abroad. The result of such developments in our nation has been the adoption in our computer centers of an automated system for preparing data on magnetic tape of the SPD-9000 type, as well as of the YeS-9001 devices for preparing data on magnetic tape. These make it possible to write information on magnetic tape in the codes of the YeS, as well as the "Minsk-32" computer.

Our nation is successfully using equipment and systems for preparing data on magnetic information carrying media made by member-nations of CEMA. These include: the YeS-9002 device for preparing data on magnetic tape, the YeS-9003 automated system for preparing data on magnetic tape, the YeS-9004 device for preparing data on magnetic tape, the YeS-9112 device for preparing data on floppy disks and others.

Literature on the issues considered in this book is virtually non-existent. Thus, the goal of this book is to fill in this gap and to do an adequate job of fully covering issues involving the preparation of data on computer media during the course of the technological mode of operation of information processing in the computer center.

This book consists of four chapters.

Chapter 1 reveals the basic technological stages of information processing in the computer center. The general structure of this production process is considered. In connection with this, information is briefly given providing rules for the requester to follow in preparing and filling out primary documents and regarding the reception, recording and checking of information in the appropriate subdivision of the computer center, preparation and checking of punched cards, punched tape and magnetic tape, information processing by the computer, etc. This knowledge is essential to computer center operators and technicians if they are to have a correct understanding of the execution of information processing in the computer center.

Chapter 2 is devoted to the description of the features of computer information carrying media: punched cards, punched tape, magnetic tape and disks. A comparative description is made of these computer information carrying media, noting the advantages and shortcomings of each. Such information is very important in planning the computer processing of economic information and in a rational selection of the most appropriate information carrying media. Rules for coding information on punched cards and tapes are given for the codes of the "Minsk-32" (GOST 10859-64) and YeS (GOST 13052-74) computers and in international code No 2. These are essential to operators for determining the reliability of input information.

Chapter 3 considers issues involving the preparation of data on punched card and tape information media. Operating procedures are given for operators using the UPDK (Device for Preparation of Data on Punched Cards) and UPDL (Device for Preparation of Data on Punched Tape) "Brest-1" for the "Minsk-32" computer and also various devices for preparing punched cards and tape for the YeS computer; namely: PA80-2/3M, KA80-2/3M, YeS-9020 and "Prepamat". A technical description of features is given for the YeS-9080 and "Zoyemtron-415,425" devices for the preparation and checking of data on punched cards, the YeS-9011 and YeS-9017 devices for marking and interpreting information on punched cards and also for the YeS-9024 device for preparing data on punched tape. Rules for punching programs in algorithmic languages for the "Minsk-32" computer (YaSK, COBOL) and YeS computers (PL-1, Assembler, FORTRAN, COBOL) are considered. Various methods of quality control for the preparation of punched media are expounded.

The last chapter, chapter 4, contains information on the preparation of data on magnetic information carrying media. Our nation's first automated system for preparing data on magnetic tape, the SPD-9000, its components, the structure of its hardware and software and its techniques for preparing and checking data are considered. Data processing on the SPD-9000 by means of a package of application programs, which represents the furthest development of the program capacities of the systems, is considered separately. The package of application programs is designed for auxiliary processing of data: data checking by means of horizontal and vertical data balance, data checking on the basis of modulus, use of limiting values to check data, data copying and editing, transformation of data structures, printing data on the teletype and alphanumeric printing systems, etc.

A package of programs has been put to a wide range of practical applications in the computer centers of the scientific-production association ASU (Automated System of Control) "Moskva". The package already contains 18 programs, in the incorporation of which the author of this book has participated. At present, the systems package of application programs is still being added to. Thirty examples are cited to demonstrate the most frequently encountered tasks in auxiliary data processing using the application programs package.

This chapter also contains information on data preparation on the YeS-9001 device. In addition, it briefly considers the YeS-9002, YeS-9003, YeS-9004, YeS-9006, YeS-9112, YeS-9112s, YeS-9150 and SPD-9000M devices and systems for preparing data on magnetic media.

The material in this book covers the technology for preparing data on computer information carrying media and contains practical principles for data preparation and checking using the devices and systems most commonly found in computer centers.

This book is intended for instructing operators and technicians in computer centers and may be used as a textbook on the fundamentals of data preparation on punched and magnetic information carrying media.

Computer	Input from punched cards, cards/min.	Input from punched tape, lines/sec	Input from magnetic tape	Input from magnetic disk, bytes/sec.
"Minsk-32"	600	1500	6000 bits/sec.	--
YeS-1022	1200	1500	64000 bytes/sec.	156000

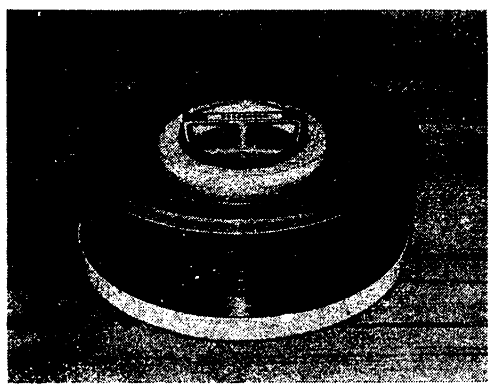

Figure 5. YeS-5261 Magnetic Disk Pack

YeS-5053 Disk Pack. In the YeS-5053 removable disk pack, operating with the NMD (Magnetic Disk Storage Unit)-5052, there are 10 working disk surfaces, labelled 0-9. The bottom surface of the top disk is the zero'th surface, the top surface of the next disk is the first surface, its bottom surface is the second surface, etc. The top surface of the bottom disk in the pack is the ninth surface.

Each disk surface contains 203 concentric tracks, on which information is written. The tracks are numbered from 0 (on the outer edge of the disk) to 202 (at its center). The capacity of each track is 3625 bytes and the capacity of the whole pack is 7.25 million bytes. Of the 203 tracks, 200 are for data and the remaining ones are service tracks. Ten tracks of the pack with the same number make up a cylinder, the capacity of which is 36,250 bytes. Writing and reading of information is done by magnetic heads using a sequential code within the bounds of one cylinder, after which the process goes on to the next cylinder.

Disk packs may be demounted and stored for the next use like reels of magnetic tape.

YeS-5261 Disk Pack. In the YeS-5261 removable disk pack, operating with the NMD YeS-5061, there are 20 working disk surfaces, located on 11 aluminum disks with ferromagnetic coating. Each of the working surfaces consists of 203 concentric tracks (200 working, 3 back-up).

Each set of 20 tracks with the same number forms an information cylinder, so that a pack has 203 concentric cylinders. Each cylinder is served by 20 floating magnetic heads.

Basic parameters of the pack:

Maximum memory size: - $29.176 \cdot 10^6$ bytes;
Maximum packed density - 88 impulses/mm;
Rate of data transmission - 312 Kbytes/sec.

3.3. PREPARATION OF DATA FOR PROCESSING IN THE YeS COMPUTER

To prepare data on punched cards and tape for the YeS computer, computer centers currently use devices manufactured in our nation as well as in member-nations of SEMA.

Of the domestically manufactured devices for preparing and checking numeric and alphanumeric information on punched cards and tapes, only those are used where the information codes correspond to the YeS computer code in GOST 13052-74. These include the PA80-2/3M, KA80-2/3M, YeS-9011 and YeS-9017, the most common devices for the preparation and checking of data on punched cards and the YeS-9020 and YeS-9024 for punched tape.

In our nation, we also successfully use devices for preparing data on punched media which are manufactured in the member nations of SEMA. These include the YeS-9080 devices for preparing data on punched cards and the "Zoyemtron-415,425" card punches and verifiers made in GDR, and the "Prepamat" devices for preparing data on punched tape made in the Hungarian People's Republic and others.

Below we give a description of the operating procedures for the devices for preparing data on punched media for the YeS computer most commonly used in computer centers.

Chapter 4 PREPARATION OF DATA ON MAGNETIC MEDIA

Computer information processing requires that the information first be prepared on computer information carrying media. These include punched cards, punched tape, magnetic tape and disks.

However, the preparation of punched media is the most labor intensive activity and greatest bottleneck in the process of information processing in the computer center.

At present, our domestic industry has mastered the production of devices for preparing and checking data on magnetic tape. These include the SPD-9000 automated system for data preparation and also an UPDML (device for data preparation on magnetic tape) of the YeS-9001 type.

Additionally, devices and systems of data preparation on magnetic tape made in member-nations of SEMA are being utilized successfully in the USSR. These include: YeS-9002, YeS-9003, YeS-9004, YeS-9006, YeS-9112 and others.

4.1 PREPARATION OF DATA ON THE SPD-9000

The SPD-9000 (Fig. 35) is the first system in the USSR designed for the preparation of data on magnetic tape. The system consists of a series-produced M6000 mini-computer and operators' consoles.

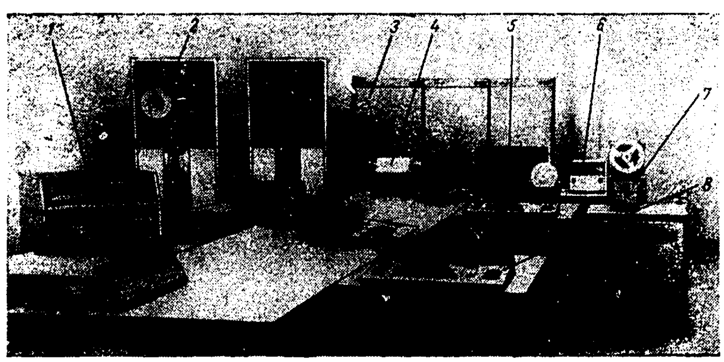

Figure 35. The SPD-9000 Automated System for Preparing Data on Magnetic Tape
1-YeS-5052 magnetic disk storage unit; 2- YeS-5012 magnetic tape storage unit; 3- M6000 processor; 4- "Konsul-260" teletype; 5- control panel for M6000 processor; 6- PL-150 punch; 7- FS-1500 photoreader; 8- operator's console.

Information is written on a standard magnetic tape, which can be used for input and processing on the unified series, ASVT-M (Modular System of Computer Technology) and the "Minsk-32" computers.

The basic functions of the system are:

input of source data from primary documents;

formal checking of data as they are input from the console (on the basis of line and field length, legality of character set on a line etc.);

verification of data by means of a second input by another operator;

update of data on the disk;

organization of packets on the systems disk;

writing of data on magnetic tape;

processing of the data on the tape by means of a package of application programs (arithmetic horizontal and vertical checking of data, checking of data by modulus 7,9,11, checking of individual fields by means of limiting values; blocking lock-out, truncation and change in the packing density of records; printing of data on the system teletype and alphanumeric printer; merging and split of data on the magnetic tape, copying and editing of data).

The system provides the operator with the necessary information about the data input from the console, i.e., display of the symbol (one) input and its address.

4.1.1 THE STRUCTURE OF THE SYSTEM AND TECHNICAL DATA CONCERNING ITS DEVICES

The automated system for preparing data on magnetic tape includes: the M6000 mini-computer processor; main memory (OZU); magnetic disk storage (NMD); channel with direct access to memory (KPDP); "Konsul-260" teletype; FS-1500 photoreader; PL-150 punch; operators' consoles (8-32).

Additionally, the system may be hooked up to a YeS-7184 ("Videoton-1010") DW21 or DZM-180 alphanumeric printer.

The M6000 Processor (Fig. 37)

Purpose - reception of information from the memory units (ZU) and input-output devices; arithmetic and logical processing of the information and output of results.

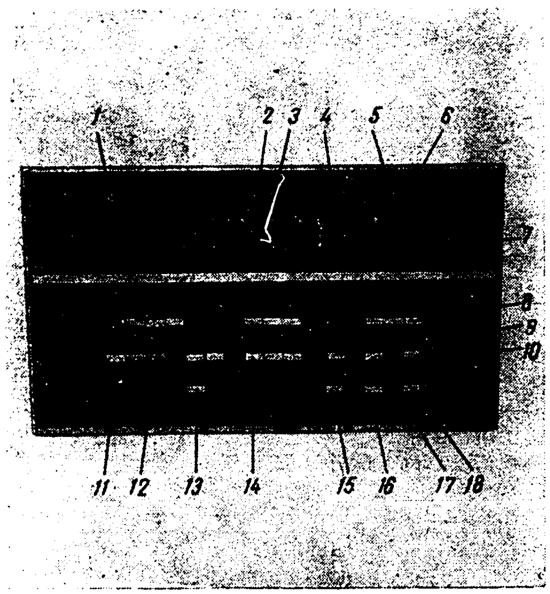

Figure 37. M6000 Control Panel

1- "Net" light; 2- RR register light; 3- RP resister light; 4- "Error" light; 5- "Halt" light; 6- lights displaying contents of registers RA, RNK, RD: 7- lights displaying contents of registers RB and RTA; 8- keyboard register (KR); 9- "WRITE" key; 10- "AUTOMATIC" key; 11- key for turning on net; 12- set of keys for displaying registers RA, RNK, RD, RB and RTA; 13- key for protecting loader; 14- set of keys for entering data in registers RA and RB; 15- key for halting processor; 16- "RESET" key; 17- key for reading registers; 18- "START" key; (RR - extension register; RP - overflow register; RA and RB - registers for working storage of operands and results of operations; RD - data register; RNK - register of instruction number; RTA - register of current address)

Technical data on the device:

Number representation in the form of 16-bit words of fixed point format with a supplementary code containing the sign in the zero bit.

Direct (to page zero and current page in memory) and indirect (to the whole memory) addressing.

Size of pages in memory	1024 words
Instruction system	zero-one address
Number of executable instructions	80
Size of main memory (OZU)	16K words

Input/output devices (UVV) are hooked up to the processor by a unified link of the 2K type. The number of input/output devices hooked up to the processor cannot exceed 8.

Type YeS-5052 Magnetic Disk Storage Device (Fig. 38)

Purpose - storage of a library of systems attributes documents (formats and models), storage of a software system (SMO) and package of application programs; storage of data arrays, which have been or are being generated.

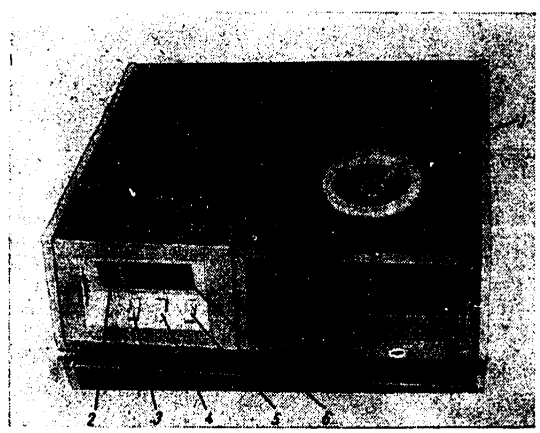

Figure 38. YeS-5052 Magnetic Disk Storage Device: 1- YeS-5053 removable disk pack; 2- storage device number display; 3- "REMOTE-OFF-LINE" key; 4- "READ-WRITE" key; 5- "START-STOP" key; 6- cylinder number display.

Technical data on the device:

Capacity of the pack, million bytes	- 7.25
Mean fetch time, microseconds	- 60
Capacity, bytes	
tracks	- 3570
cylinders	- 35700
Transmission rate, bits/sec.	- $1.25 \cdot 10^6$

YeS-5012 Type Magnetic Tape Storage Device (Fig. 39)

Purpose - copying of data from disk to magnetic tape in YeS computer code.

Technical data on the device:

Type of storage	- YeS-5012
Capacity	- up to 24 Mbytes (tape length = 750mm)
Packing density	- 8 or 32 characters/mm
Tape speed during data write or read	- 2 m/sec.
Speed of rewind or unload	- 5 m/sec.
Maximum diameter of magnetic tape reel, mm	- 267

FS - 1500 Photoreader (Fig. 40)

Purpose - input of real-time systems programs for data input and checking, application program packages and also utility programs (test, disk etc.)

Technical data on the device:

Type	- FS 1500
Read rate, lines/sec.	- up to 1500

PL-150 Punch (Fig. 41)

Purpose - output on magnetic tape of the contents of various programs of the SRV (time sharing system) library and of the package of application programs.

Technical data on the device:

Type	- PL-150
Width of punched tape/mm	- 17.5, 25.4 (GOST 1391-70)
Speed of data punch, chars./sec.	- 150

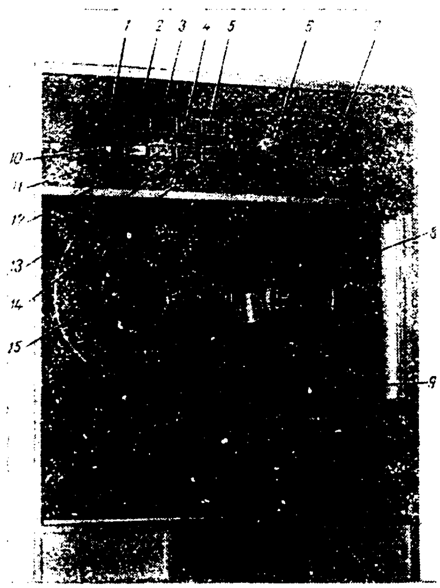

Figure 39. Magnetic Tape Storage
1 - Power supply on key;
2 - Power supply off key;
3 - "FETCH" key;
4 - "WRITE PROTECT" key;
5 -"STATUS OF RECORD" key;
6 - Storage unit number switch;
7 - Storage unit number display;
8 - Magnetic tape cassette;
9 - Tape drive; 10 - "REWIND" key;
11- "Load" key; 12 - "READY" key;
13-"UNLOAD" key; 14 - "RESET" key;
15 - Receiving cassette.

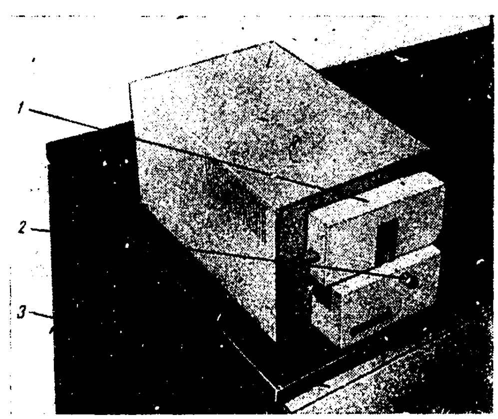

Figure 40. FS-1500 Photoreader

1 - hinged arm;
2 - tape width regulator;
3 - table

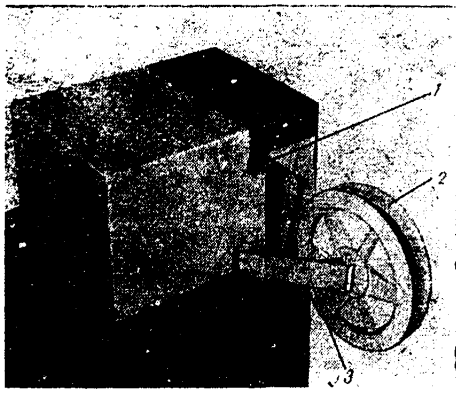

Figure 41. PL-150 Punch:

1 - tape guide; 2 - punched tape cassette; 3 - detachable unit for unwinding tape

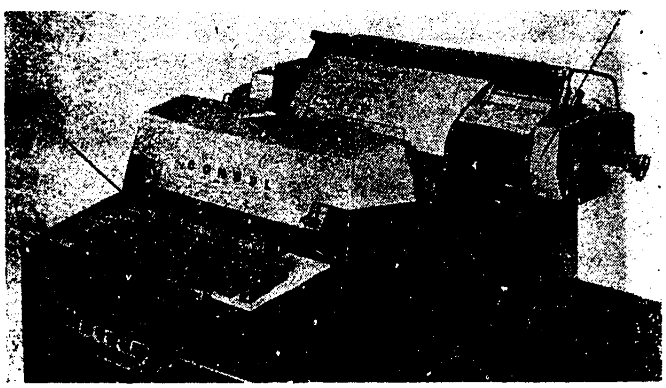

Figure 42. "Konsul-260" Teletype

1 - teletype control panel; 2 - alphabetic keyboard; 3 - carriage

"Konsul-260" Teletype (Fig. 42)

Purpose - dispatching console for input into the system of attribute documents (formats and models), attributes of data packets and writing of packets on magnetic tape, allocation of work among operators, receipt of information during input of data into the system and information about the status of the system as a whole, with output of data on paper tape.

Technical data on the device:

Print speed, characters/sec.	- up to 10
Number of characters per line	- up to 106
Width of paper roll, mm	- up to 280

YeS 7184 Alphanumeric Printer (Fig. 43)

Purpose - printing of data written on magnetic tape in codes for the YeS, "Minsk-32" and ASVT-M computers.

Technical data on the device:

Type	- YeS-7184 ("Videoton-1010")
Maximum length of printed line	- 80 characters
Print output rate, lines/min.	- 253-283
Width of printfield, mm	- 205
Paper	- punched on both edges, accordion folded ("leporello")

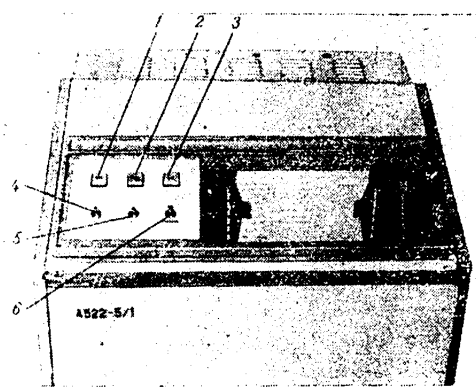

Figure 43.
YeS-7184 Alphanumeric printer

1- "NET" key; 2- "READY" key; 3- "VK" (ON) key; 4- "PF" (expansion unknown) switch; 5- "PS" (expansion unknown) switch; 6- "On-Off Line" switch

Operator's Console (Fig. 44)

The operator's console is a terminal device and is intended for use in input of alphanumeric and service information into the computer.

Technical data on the device:

Symbol code	- GOST 13052 -74
Rate of data input, characters/sec.	- up to 10
Major modes of operation	- data input, data check
Number of advisory messages from computer	- up to 18

Components of the console:
- table;
- display panel;
- keyboard.
- Display panel includes:
  - symbol display;
  - four-character display showing position of symbol, line number, model or format number;
  - status display;
  - display showing information about errors and messages from the computer;
  - operator console number display.
- The console keyboard includes:
  - alphanumeric key set (48 keys);
  - numeric key pad for inputting data "blind" (11 keys);
  - function keys.

YeS09006 Data Preparation Device

The YeS-9006 data preparation device (Hungarian People's Republic) is intended for the preparation and checking of data on cassette magnetic tape.

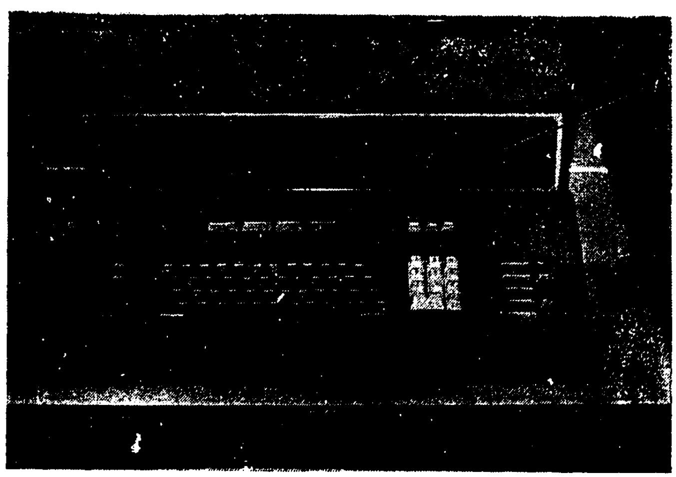

Figure 44. SPD-9000 Operator's Console
1- display panel; 2- operator's table; 3- console keyboard

Technical data on the device:

Type of cassette	- any "COMPACT" type
Tape used	- standard for sound recording
Capacity of type C90 cassette, Kbytes	- 180
Length of records, characters	- 80 or 160
Number of programs	- 2
Checking method	- verification and program

The device permits performance of the following functions: input, checking, search and updata of data and writing of data on magnetic tape. The device may be hooked up to the YeS-9006 magnetic tape data transmission device (UPDML), a cassette magnetic tape storage unit, a YeS-5094 alphanumeric printer, a card reader and a "Konsul" teletype.

YeS-9112 Data Preparation Device

The YeS-9112 data preparation device (People's Republic of Bulgaria) is intended for preparation of data on a floppy magnetic disk.

Technical data on the device:

Length of a record block, characters	- 1 - 128
Number of symbols displayed on the console screen	- 256
Number of control programs	- 10
Data display	- blocked
Major modes of operation	- data input and verification, data search and update
Power required, kW	- 1.0
Overall dimensions, mm	- 1050 X 750 X 650
Weight, kg	- 150

The YeS-9112 is composed of two floppy disk memory units, a control block, a monitor and a keyboard. The operator uses the keyboard to enter data into the device. The quality of the data is verified with the aid of the monitor at the same time. The use of the floppy disk as an information carrying medium makes possible rapid search and update of information.

The device can be hooked up to auxiliary devices: a printer, for printing out the data, a magnetic tape memory unit and an adapter for remote linkage with a YeS computer.

The YeS-9112s Data Preparation Device

The YeS-9112s data preparation device (Hungarian People's Republic) is intended for data preparation and checking on floppy disks.

Technical data on device:

Capacity of disk pack, Kbytes	- 242,944
Number of tracks	- 74
Number of sectors per track	- 26
Length of a document, bytes	- 128
Operator's console	- display with CRT screen
Rate of data read, characters/sec.	- 20000
Generation of data packets	- automatic
Types of checking	- verification and program

The device allows performance of the following functions: data input with visual representation on display, reading of data, data search (by address, or content), data check and update.

The device can be hooked up to an alphanumeric printer and also, through a modem, can enter into a data teleprocessing system.

The YeS-9150 Multiconsole Data Preparation System

The YeS-9150 multiconsole data preparation system (Polish People's Republic) is intended for preparing and checking data on magnetic tape.

The main components of the system are: the processor, magnetic tape storage, magnetic disk storage, alphanumeric printer and operators' consoles.

Technical data on the device:

Operator's console	- display with CRT screen
Number of consoles	- 32
Capacity of CRT screen, characters	- 480
Dimensions, mm	- 440 X 300 X 600
Disk Storage	
Number of storage units	- 2
Memory size of storage unit, Mbytes	- 2.5
Magnetic Tape Storage	- YeS-5001
Packing density, characters/mm	- 32 or 63
Capacity of main memory, Kwords	- 32
Alphanumeric printer	
Type of print	- dot matrix
Print speed, characters/sec.	- 180

The system allows performance of the following functions: data input from displays, programmed data checking, updating and writing on the magnetic tape in YeS computer codes.

SPD-9000M Multiconsole Data Preparation System

The SPD-9000M data preparation system (USSR) is designed for preparing and checking data on magnetic tape in YeS computer codes.

The main components of the system are: the central processor, magnetic disk storage, magnetic tape storage, alphanumeric printer and operators' consoles.

Technical data on the device:

SM EVM (System of Small Computers) Processor	- SM-1P
Capacity of main memory, Kwords	- 16
Magnetic disk storage	- IZOT 1370
Number of storage units	- 2
Capacity of unit, Mbytes	- 5
Rate of information exchange, Kwords/sec.	- 156
Mean access time, msec.	- 57.5
Magnetic tape storage	- IZOT 5003
Number of storage units	- 2
Magnetic tape capacity, Mbytes	- up to 12
Tape width, mm	- 12.7
Reel diameter, mm	- 216
Packing density, characters/mm	- 32
Alphanumeric printer	- DZM-180
Type of print	- dot matrix
Print speed, characters/sec.	- 180
Number of characters per line	- 158
Operator's console	- display with CRT screen
Number of consoles	- 8-32
Data input rate, characters/sec.	- up to 10
Distance between console and computer, km	- up to 1
Checking method	- verification, systems (format) check, program
Volume occupied, cu.m	- 50

The system allows performance of the following operations: input, checking and update of data from the operator's console (replacement, insertion, deletion), processing of data written on the tape by means of application programs (conversion of files on the tape, editing of files on the tape, printing of data on the alphanumeric printer, programmed data checking).

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CONTENTS

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AUTOMATING CONTROL OF TECHNOLOGY FOR PRODUCING ELECTRONIC INSTRUMENTS

Moscow METODY AVTOMATIZIROVANNOGO UPRAVLENIYA TEKHNOLOGIYEY PROIZVODSTVA ELEKTRONNYKH PRIBOROV in Russian (signed to press 7 Aug 81) pp 2-4, 125-128

[Annotation, preface, bibliography, and table of contents from book "Techniques of Automated Control of the Technology for Producing Electronic Instruments" by Anatoliy Ivanovich Kuchin, Leonid Andrianovich Radchenko and Yuriy Kazimirovich Lesish, Izdatel'stvo "Radio i svyaz'", 4,000 copies, 128 pages]

[Text] Annotation

This book reviews techniques of automated control of the fundamental operations of thermal technology (metalization and soldering of ceramic assemblies, heat treatment of semiconductor structures, annealing, and so on) and vacuum-technological and galvanic processes, automated assembly and installation of the electrodes of generator instruments, and automated roentgenostroboscopic monitoring of the stability of shape of the design elements of electronic instruments.

The book is intended for workers in the electronics industry and related sectors who are specializing in electronic and radio instrument building and in development of automated control systems for industrial processes [ASUTP's].

Preface

The prime cost of electronic instruments, their reliability, simplicity of production, and the time spent on their manufacture depend significantly on technology. When working out the technological process, therefore, primary efforts must be directed to organizing production to raise labor productivity and increase the production of articles per unit of production equipment not only by refining and organizing technology, but also by automating control based on optimization of industrial (technological) processes.

One of the main directions in optimization of the technology of manufacturing the parts of electronic equipment is developing and introducing computer-based ASUTP's in production. This has become possible owing to the availability of highly productive and precise modern equipment and the development of a broad assortment of means of mechanizing and automating data processing.

The complexity of the industrial processes, the type of production, and the amount and diversity of industrial and monitoring equipment to produce electronic parts determine what difficulties there will be in setting up systems to control industrial processes.

Efficiency of control over increasingly complex industrial processes is achieved by constantly searching for more favorable conditions for these processes on the basis of operational data processing concerning their state and a correct strategy of process control.

The designated purposes of the ASUTP in the electronics industry are as follows [76]:

a. monitoring industrial operations by means of a controlling machine;

b. optimization of the industrial process by means of automated monitoring with control feedback;

c. determining the effect of changes in the industrial process on the quality of output and the percentage of usable parts produced;

d. raising labor productivity in assembly and monitoring operations.

It is advisable to use ASUTP's in places where industrial processes are continuous and the productivity of the industrial equipment is quite high. These factors are indicative for the technology of producing electronic instruments.

The endeavor to improve the technical-economic indicators of industrial processes by control means necessitates modernization, and in many cases also a significant reorganization of the structure of industrial operations and equipment. Experience shows that the development of control systems for complex industrial processes goes through three stages [77].

1. Formulating the controlled and observed industrial process. In this stage the industrial process is shaped as an object of control. The characteristics of the parts being made can be modified by controlling the industrial process. Therefore, it is essential to work out an optimal structure and method of realizing the industrial process that insures efficiency of control, to build industrial equipment that is appropriate to the resulting structure of the process, to equip it with data sensors and actuating devices, and to organize the necessary information flows.

2. Construction of mathematical models and algorithms of control over industrial processes. Industrial processes in electronics engineering are complex control objects whose state depends on many factors which frequently cannot be monitored. Efficient control of such processes is only possible where the basic patterns that

characterize them and the relations between input and output parameters of the process have been studied and represented in the form of mathematical models that reflect the static and dynamic characteristics of the process. Mathematical models are the foundation for formulating the algorithms of control of the industrial process, that is, for formalization of decision-making on controlled shaping of the characteristics of parts and indicators of their production. The algorithm put into the optimizing ASUTP is the only means of continuously insuring a search for the optimal way to raise the productivity of the process and improve the quality of the product being made. Formulation of a mathematical model of the process that reflects its static properties makes it possible to select the optimal industrial regime and work out the algorithm for control of the process of shaping the characteristics of parts "on the average" [33]. The mathematical model that reflects the dynamic properties of the process makes it possible to work out an algorithm to modify the industrial regime to compensate for the effect of unmonitored factors on the process of shaping the characteristics of the articles. Continuous modification of the industrial regime greatly diminishes the variation in characteristics of articles at the output of the process and insures stability under conditions of series production.

3. Development of the hardware of the system, its particular elements, installation, and comprehensive debugging of the ASUTP. Experience shows that the first two stages may take up the 75 percent of total development time for the ASUTP.

The present book reviews the questions of optimizing industrial processes and constructing formalized models of them for machine control. It tells about methods of constructing ASUTP's and gives specifications on ASUTP's that have been developed. The book reviews the basic industrial processes of producing electronic instruments.

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